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WAMPUM AND ITS HISTORY.

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THE use of a circulating medium to facilitate commerce by simplifying the awkward devices of barter, is supposed to indicate a considerable advance towards civilization in the people employing it. On this score the North American Indians ought to stand high in the list of barbarians, since they possessed an aboriginal money of recognized value, although it had no sanction other than common custom. This money was made from sea-shells, and was known by various names, of which one has survived popularly—*wampum*—to designate all varieties of shell beads and money.

Sea-shells, indeed, seem to have commended themselves for this purpose to widely different peoples. The great circulation which the cowrie-shell (*Cypræa moneta*) attained in tropical Africa, India and the South Sea islands, will occur to the reader. It was once the coin of those regions in trading with the savages to the exclusion of everything else; and ships going after cargoes of ivory, palm oil, sandal wood and similar products, were obliged first to provide themselves with cargoes of cowries, at Zanzibar or some other port where they could be bought.

All that was required to turn a cowrie into a coin was to find it and punch a small hole in it. But the American money was a distinct advance upon this, since it was a manufactured article. In addition to the exertion of securing the mollusk's shell, there was a large expenditure of labor in fashioning the bead which acted as a coin. Lindstrom (in Smith's History of New Jersey) says an Indian's utmost manufacture amounted only to a few

pence a day; and all writers enlarged upon the great labor and patience needed to make it, especially at the South. Hence the purchasing power of a wampum bead was far in advance of that of a cowrie, the dentalium of the Pacific coast, or any other unwrought shell used as money; and this form was probably an evolution from the use of single small shells, which still prevail to some extent on the western shore of the continent. Many small fresh-water shells, suitable for stringing and unsuited for ornamental purposes, have been found in mounds and graves in the Mississippi valley, and many archæologists believe that these were employed as the currency of the tribes of that region; it is very probable, but there seems to be little or no positive evidence (of record), that such was the case.

The very earliest accounts of North America show that this money was in common and widespread service among the natives as far north as the Saskatchewan, and westward to the Rocky mountains. Among the far western tribes, who obtained it after a succession of barterings through races living between them and the coast, the beads came to be considered rare and precious, and were devoted almost wholly to ornament; but everywhere east of the Mississippi their circulation commonly as a buying and selling medium seems well assured. The evidences of this are derived not only from the accounts of early visitors to the tribes of the interior, but from relics abounding at their village sites and in their graves.

The Pacific coast had a shell-money of entirely different character from that of the Atlantic side of the continent, but I defer reference to it until later. The eastern money consisted of elongated beads of two colors, white, and purplish or brownish black.

The white variety was most plentiful and of inferior value. It was commonly made from the large univalves, *Sycotypus canaliculatus* and *Fulgur carica*, whose pear-shaped, coiled shells are sufficiently alike to be easily confounded under the vernacular terms "periwinkle," "winkle" or "conch." But sometimes other material was used. Thus the "New England's Rarities" discovered by John Josselyn, gent., reads: "A kind of coccle of whose shell the Indians make their beads called wampumpeage and mohaicks. The first are white," etc. This is an exception. Roger Williams wrote in his "Key:" "The New England Indians are ignorant of *Europe's coyne.* * * * Their owne is of two

sorts; one white, which they make of the stem or stock of the *Periwincle*, which they call Meteaûhok, when all the shell is broken off." Again he says: "Their white they call *Wampam* (which signifies white)." Loskiel, however, tells us that *wompom* was an Iroquois word "meaning a muscle." The wampum made from the periwinkle was distinguished in law as late as 1663 in Rhode Island, and in 1679, Wooley, describing New York, says of it: "They [the Indians] make their White Wampum or Silver of a kind of Horn, which is beyond Oyster-bay"—a phrase that certainly would not apply to a bivalve.

It appears certain, then, that the coiled, univalve, periwinkle shells (they are from six to ten inches in length) were largely used for this inferior grade of currency. It was only necessary to take out one or two small sections of the central column of the spire and smooth the edges; the hollow core made them natural beads. Smith's "History of New Jersey" (1765) informs us that this was precisely the plan followed, for it relates that "the white wampum was worked out of the inside of the great conques into the form of a bead, and perforated to string on leather." Still earlier testimony comes from the southern coast. Thus Beverly, in his "History and Present State of Virginia" (1705), records that the riches of the Indians there consisted of "*Peak, Roenoke* and such-like trifles made out of the *Cunk Shell. Peak* is of two sorts, or rather of two colors, both are made of one Shell, tho' of different parts; one is a dark Purple Cylinder, and the other a white; they are both made in size and figure alike." The same author also mentions a poorer kind of money yet, "made of the cockle shell, broke into small bits with rough edges, drill'd through in the same manner as Beads, and this they call *Roenoke*." Other authorities corroborate this and prove what I have been led to enlarge upon—the fact that the conchs were used mainly for the white money,—because the popular idea has been that *all* the shell money was made from the valves of quahaug.

This bivalve is one of the commonest mollusks on the shore of eastern America south of Cape Cod. It is a thick, somewhat globose shell which buries itself in the sand under pretty deep salt water. The Indians gathered it alive by wading and feeling with the toes or by diving, and ate the animal with great gusto; it remains, indeed, an article of extensive sale in all our markets under the name of round or hard clam or quahaug, the scientific name being *Venus mercenaria.*

Toward the anterior end of the otherwise white interior of each of the valves of this mollusk's shell is a deep purple or brownish-black scar indicating the point of muscular attachment—fishermen call it the "eye." This dark spot was broken out of the shell by the Indians, and formed the material of their more valuable coins. In descriptions of it we meet with a new list of terms and additional confusion. It was worth, on the average, twice as much as the white variety; and the latter was frequently dyed to counterfeit it. Moreover, Loskiel is authority for the statement that the natives of the New Jersey coast "used to make their strings of wampum chiefly of small pieces of wood of equal size, stained either black or white." These were held far inferior to shell-beads of either color; but I know of no other example of this species of counterfeiting or substitution.

In New England Roger Williams describes this superior money as follows: "The second is black, inclining to blue, which is made of the shell of a fish which some English call *Hens, Poquaûhock.*" This money, he says, was called "*Suckáubock*[1] (*Súcki* signifying blacke)." Josselyn gives *mohaicks* as the Connecticut word. Among the Dutch on the Hudson river (and frequently elsewhere) *seawant* was the usual term, and they spoke of it as black or white. There the various shades of blue, purple and dull black found separate names, but made no change in value. In notices of it among the early writers, whose carelessness is apparent, the words *wampum, wompam, wompom, wampampeege, wampumpeage, wampeage, peage, peag, wampum peak, mohaicks, suckauhock, seawan, seawant, roenoke, ronoak* and others occur. Seawant appears to have been properly a generic term indicating any and all kinds of shell money; wampum was often used thus and is now so used altogether; but originally it seems to have meant the white beads alone, while the words *peag* (in its various forms), *suckauhock* and *mohaicks* represented the black. In Beverly's "Virginia," however, this is precisely reversed, which leads us to believe that the author made a mistake; southern writers unite in making *peak* generic, while *roenoke*[2] is a word unknown at the North. All of these terms are misspelled derivatives from roots meaning

[1] Misprint for suckau*h*ock.

[2] "*Roanoke* (a small kind of beades) made of oyster shells, which they use and pass one to another, as we doe money (a cubites length valuing six pence)." *Hariot.* (1614), p. 41. *For "a bushel" of these Powhatan sold his daughter.*

"shell," and the Indian names for the *Venus* show their close affinity with the group. "Porcelan" was a Dutch appellation.

Some of the methods of making this finer sort of bead-coin are interesting. "Before ever they had *awle-blades* from Europe they made shift to bore their shell-money with stone." This was around Narragansett, and in the shell-heaps along the New England coast are hidden these old flint awls of prehistoric design, which may have been spun in some cases by a small bow such as jewelers employ at present. In Virginia Beverly found that both sorts of *peak* were "in size and figure alike and resembling the *English Buglas*, but not so transparent nor so brittle. They are wrought as smooth as glass, being one-third of an inch long and about a quarter in diameter, strung by a hole drilled through the center." Lawson describes the drilling, "which the Indians manage with a nail stuck in a cane or reed. Thus they roll it continually on their thighs with their right hand, holding the bit of shell with their left; so in time they drill a hole quite through it, which is very tedious work, but especially in making their ronoak." Brickell (1737) is worth reading on this point also.

The coinage, so to speak, of this shell-money was, therefore, a work of patient labor, and there was no fear of increasing the supply beyond the demands of trade by the worth of one deer-skin, since a savage would rarely make a single bead more than sufficed for his immediate necessities. It was a true medium of exchange—real currency. All the early accounts speak of it as "riches" and "money" and "current specie." "This," says Lawson, "is the money with which you may buy skins, furs, slaves, or anything the Indians have; it being the mammon (as our money is to us) that entices and persuades them to do anything and part with everything they possess except their children for slaves. As for their wives, they are often sold and their daughters violated for it. With this they buy off murders; and whatsoever a man can do that is ill, this wampum will quit him of, and make him, in their opinion, good and virtuous, though never so black before."

The Delawares in fact had a tribal treasury of wampum, out of which were paid the expenses of public affairs. At certain feasts a great quantity of it was thrown upon the ground to be scrambled for by the youngsters—carnival fashion. Hired servants at these feasts or anywhere else were paid in wampum.

It followed as a matter of course that the shrewd first traders who came to New York and New Jersey should adopt this currency which all the natives were accustomed to, receiving it as pay for their merchandise. They used it to buy peltries of the Indians. Thus wampum quickly became a standard of values, the currency of the colonists to a great extent in their transactions with each other, and even a legal tender.

Though the beads were often used separately, the ordinary and approved manner was to string them upon the sinews of animals or upon cords, which might or might not be woven into plaits about as broad as the hand, called wampum belts. The length of these strings varied, but in the North about six feet was found the usual quantity computed by the Indians, and hence the *fathom* became the unit of trade. In the Carolinas, according to Lawson, the strings were measured in cubits, "as much in length as will reach from the elbow to the little finger."

The Indians themselves were particular as to quality and size of the beads, for upon the elegance of its finish (speaking scientifically, the amount of labor and time it represented) depended its value. "When these beads are worn out," says Lindstrom, an engineer in New Jersey in 1640, "so that they cannot be strung neatly, and even on the thread, they no longer consider them as good. Their way of trying them is to rub the whole thread full on their noses; if they find it full and even, like glass beads, then they are considered good, otherwise they break and throw them away. Their manner of measuring their strings is by the length of their thumbs; from the end of the nail to the first joint makes six beads."

Seeing that profit and wealth lay in the possession of wampum, the burghers, as the easiest way of getting rich, began to make it. With their tools of steel this could be done very rapidly; but with the loss of the painstaking care with which the Indian wrought, came a loss of value, and the wampum very soon began to depreciate. To widen their market it was carried to New England. Considering the many references to it, and the undoubted fact that it was made there aboriginally as well as southward, I am at a loss to understand Gowan's statement that "the use of wampum was not known in New England until it was introduced there in October, 1627, by Isaac de Razier, who was acting as a sort of amity-treaty commissioner from the New Netherlands to

Plymouth Colony. He carried wampum thither and bought corn. To this introduction the pious Hubbard attributes all the wars which ensued between the Puritans and the Indians. "Whatever were the honey in the mouth of that beast of trade [the Dutch?] there was a deadly sting in the tail," he wails out, with much more to the same purpose. The authority for Gowan's statement is probably an intimation in Nathaniel Morton's "New England's Memoriall" (1669), p. 67, followed by the remark that "Sundry unworthy person's" sold firearms to the Indians for it.

It was during the administration of William Kieft that the wampum currency was of greatest importance in New York. Washington Irving, in his Knickerbocker History, Chapter VI, gives a humorous account of it and the troubles to which it gave rise. Kieft began by endeavoring to flood the colony with this Indian money, which the Indians were content to take in exchange for their peltries, but which of course had no intrinsic value. Says the veritable Diedrich:

"He began by paying all the servants of the Company and all the debts of the government in strings of wampum. He sent emissaries to sweep the shores of Long Island, which was the Ophir of this modern Solomon, and abounded in shell-fish. These were transported in loads to New Amsterdam, coined into Indian money and launched into circulation.

"And now for a time affairs went on swimmingly. * * * Yankee traders poured into the province, buying everything they could lay their hands on, and paying the worthy Dutchmen their own price—in Indian money. If the latter, however, attempted to pay the Yankees in the same coin for their tin ware and wooden bowls, the case was altered; nothing would do but Dutch guilders and such like 'metallic currency.' What was worse, the Yankees introduced an inferior kind of wampum made of oyster-shells, with which they deluged the province, carrying off in exchange all the silver and gold, the Dutch herrings and Dutch cheeses; thus early did the knowing men of the East manifest their skill in bargaining the New Amsterdammers out of the oyster, and leaving them the shell.

"It was a long time before William the Testy was made sensible how completely his grand project of finance was turned against him by his Eastern neighbors; nor would he probably have ever found it out had not tidings been brought him that the Yankees had made a descent upon Long Island, and had established a kind of mint at Oyster bay, where they were coining up all the oyster banks.

"Now this was making a vital attack upon the province in a

double sense, financial and gastronomical. Ever since the council dinner of Oloffe the Dreamer, at the founding of New Amsterdam, at which banquet the oysters figured so conspicuously, this divine shell-fish had been held in a kind of superstitious reverence at the Manhattoes; as witness the temples erected to its cult in every street and lane and alley. In fact it is the standard luxury of the place, as is the terrapin at Philadelphia, the soft crab at Baltimore, or the canvas-back at Washington.

"The seizure of Oyster bay, therefore, was an outrage not merely on the pockets, but the larders of the New Amsterdammers; the whole community was aroused, and an oyster crusade was immediately set on foot against the Yankees. Every stout trencherman hastened to the standard; nay some of the most corpulent Burgomasters and Schepens joined the expedition as a corps de reserve, only to be called into action when the sacking commenced."

A valiant army under Stoffel Brinkerhoff having marched to Oyster bay, routed the English there, "and would have driven the inhabitants into the sea if they had not managed to escape across the sound to the mainland by the Devil's Stepping-stones, which remain to this day monuments of this great Dutch victory over the Yankees." This done—

"Stoffel Brinkerhoff made great spoil of oysters and clams, coined and uncoined, and then set out on his return to the Manhattoes. A grand triumph, after the manner of the ancients, was prepared for him by William the Testy. He entered New Amsterdam as a conqueror, mounted on a Narragansett pacer. Five dried codfish on poles, standards taken from the enemy, were borne before him, and an immense store of oysters and clams, Weathersfield onions, and Yankee 'notions' formed the spolia opima; while several coiners of oyster-shells were led captive to grace the hero's triumph.

"The procession was accompanied by a full band of boys and negroes performing on the popular instruments of rattle-bones and clam-shells, while Antony Van Corlear sounded his trumpet from the ramparts.

"A great banquet was served in the Stadthouse from the clams and oysters taken from the enemy; while the governor sent the shells privately to the mint and had them coined into Indian money with which he paid his troops."

To check the evil effects of this "inflation," a law was passed in the New Netherlands, in 1641, prohibiting the acceptance of anything but fine, polished strung wampum, except at five for one stiver, while the polished was worth four for a stiver. These were echoed in Connecticut by enactments that no seawant should be

paid or received except "strunge suitably, and not small and great, *uncomely and disorderly mixt*, as *formerly it hath beene*." In Massachusetts "wampam-peag" was legal tender (Act of 1648) for all debts less than forty shillings, "except county rates to the treasurer," the white at eight for a penny and the black at four for a penny. This remained the law till 1661, but wampum served as money there long subsequent, as it did everywhere else. It would be impossible to get at the volume in circulation, but values are accessible. These remained substantially those I have mentioned until 1673, when the true wampum had become very scarce, owing to the hoarding of it by the Indians and its disposal to remote tribes. The Dutch council, therefore, issued an edict enhancing its legal value twenty-five per cent. Such an action as this the red man could not in the least comprehend. Adair says they had a fixed value for every bead, and "bought and sold at the current rate, without the least variation for circumstances either of time or place; and now they will hear nothing patiently of loss or gain, or allow us to heighten the price of our goods, be our reasons ever so strong." This was a sad case for an Indian trader!

Nearly a century passed and still the shell-money held a firm place in colonial trade, all along the coast. That observant traveler, Dr. Kalm, who visited and wrote about the American settlements in 1748, has much to say of the profits of trading through this medium in Indian goods. "The Indians," he notes, "formerly made their own wampums, though not without a deal of trouble; but at present the Europeans employ themselves that way, especially the inhabitants of Albany, who get a considerable profit by it." This last fact is also mentioned by the Reverend Burnaby, who further saw it made by white men on Staten Island.

It is only a little later, indeed, that Jacob Spicer, the most prominent man in Cape May county, New Jersey, advertised to barter goods "for all kinds of produce and commodities, and particularly for wampum, offering five dollars reward to the person making the largest amount of it. "He succeeded in procuring a quantity of the wampum, and before sending it off to Albany [cf. *antèa*] and a market, weighed a shot bag full of silver coin and the same shot bag full of wampum, and found the latter most valuable by ten per cent."

At this time and later, wampum was valued both as ornament and money by the Canadian Indians. Kalm saw it among the Hurons and also below Quebec. So slow, in fact, were the redmen to relinquish this currency, that wampum continued to be fabricated until within fifty years in several towns of New York State (chiefly at Babylon, Long Island) to meet the demand for it by western fur-traders. Glass beads were substituted at a very early day, but although they were acceptable to the savages everywhere as a trimming, they never acquired the significance and circulation as money, enjoyed by the genuine beads of shell.

Though with the tribes of the central region of North America, commercial transactions were all a matter of barter, and the standard of value, if any existed, varied with the especial local commodity, like buffalo-robes on the plains, blankets among the Navajoes and Puebloans, or otter-skins in Alaska, yet the coast tribes of the Pacific had a true money when white men first became acquainted with them.

This currency seems to have been confined nearly or quite within the present boundaries of the United States and British Columbia, and it comprised a variety of forms, one of which in the northern and another sort in the southern part of this area, approached in solid and widely recognized value the substantial wampum.

The northern and most celebrated of these varieties was the *hiqua*, *hikwa*, *hiaqua* or *ioqua*—for all these forms of the Chinook jargon word are found. *Hiqua* consisted of strings of the shell of a mollusk (*Dentalium*) called by conchologists "tusk-shells." These were gathered off the shores of Vancouver's and Queen Charlotte's islands by prodding into the sea-bottom a long pole with a spiked board at the end, upon the points of which the slender shells were caught. None were quite two inches in length, many much smaller; and among all the Indians north of the Columbia river, the unit of measurement was a string of about a fathom's length, or as much as could be stretched between the extended hands of the owner. The larger the size the greater their value; forty to the fathom was the standard, fifty to the fathom being worth scarcely half so much. Early in the present century a fathom was worth ten beaver-skins in dealing with the whites in Oregon. With the advent of the Hudson Bay Company's traders, the *hiqua* disappeared to a great extent, and values

were reckoned in blankets, as is now the case in many parts of Alaska and Arctic America.

South of the fur-trading posts, however, this money survived to a much later date, and is even yet to be seen in certain remote districts. "Those aboriginal peddlers, the Klikitats," and other Columbians, carried it to southern Oregon and to the Klamath region year after year, whence it spread through all Northern California, receiving there a new name, *allo-cochick*, and an alteration of estimate. The northern measure between the extended finger-tips was discarded on the Klamath river for a string scarcely half that length. Among the Hupas, still further southward, the standard became a string of five shells. Nearly every man had ten lines tatooed across the inside of his left arm about half way between the wrist and the elbow; in measuring shell-money he drew one end over his left thumb nail, and if the other end reached to the uppermost of the tattoo-lines, the five shells (ten years ago) were worth $25 in gold, or even more. Only one in ten thousand would reach this distinction, so that the ordinary worth of a string was ten dollars. "No shell is treated as money at all," says Mr. Powers, "unless it is long enough to rate as twenty-five cents. Below that * * * it goes to form part of a woman's necklace. Real money is ornamented with little scratches or carvings, and with very narrow strips of thin, fine, snake-skin wrapped spirally around the shells; and sometimes a tiny tuft of scarlet woodpecker's down is pasted on the base of the shell." These marks manifestly were designed to give the money some sort of sanction—make it represent somewhat the labor put upon the beads with which it had to compete.

For south of the Eel river, and thence throughout all Central and Southern California, the staple currency was a shell-money resembling the eastern wampum. *Hiqua* and *allocochick* were simply shells of some rarity, ground at the tip sufficiently to admit of being strung. The *háwok* and *üllo* of California were carefully manufactured and represented a real cost of labor and time, though they had no intrinsic value. The two were of different shape and value.

The first-named, *háwok*, was of least worth, standing in the place of the white wampum of the East or our silver. It consisted of circular disks or buttons from a quarter of an inch to a whole inch in diameter, and of the thickness of the shell from which it was cut. For this purpose a heavy bivalve was chosen,

and broken into discoidal fragments. These pieces were then ground smooth and polished by rubbing on blocks of sandstone, which often had to be brought from a long distance to the maker's rancheria. This finished, a hole was bored through the center with a wooden, flint-tipped drill forced to revolve very rapidly by a buckskin string which wound upon it, unwound and rewound itself in an opposite direction, through the incessant vertical movement of a loose cross-bar in the operator's hand. These *háwok* disks were then strung upon sinews, or on cords made of milkweed fiber, but the strings were not of invariable length, though beads of like size must be put together. The very best of this was worth twenty-five cents apiece ten years ago; but the smallest always went by the string. This white bead-money was (and to a certain extent still is) the great medium of Indian trading among themselves.

Their gold, so to speak, the *ullo*, is made from the shell of the abalone (*Haliotis*) and chiefly from the red species (*H. rufescens*). These shells are cut with flints into oblong, keystone-shaped pieces from one to two inches in length, according to the curvature of the shell, and a third as broad. Two holes are drilled near the narrow end of each piece, and they are thus strung edge to edge. "Ten pieces," wrote Powers, "generally constitute a string, and the larger pieces rate at $1 apiece, $10 a string; the smaller in proportion, or less if they are not pretty. Being susceptible of a high polish this money forms a beautiful ornament, and is worn for necklaces on gala days. But as money it is rather too large and cumbersome, and * * * [it] may be considered rather as jewelry."

A third sort of money, very rarely seen now-a-days, was fabricated on the islands off the southern coast and on the adjacent mainland. This was called *kol-kol*, and was made by grinding off the apex of the univalve shell of *Olivella biplicata* until a cord could be passed through. It was slightly esteemed.

Further south all these forms of shell-cutting disappear in their capacity of *money*, retaining value only as ornaments; so that their use in trade south of California belongs under the head of barter. Thus Bancroft notes of the natives of Sonora: "Pearls, turqoises, emeralds, coral, feathers and gold were in former times part of their property, and held the place of money."

There seems to have been an immense amount of this regular money, *hiqua*, *allocochick*, *hawok* and *ullo* on the Pacific coast;

Powers thinks an average of $100 worth to each male Indian would not be too large an estimate for California at the time of its discovery by the Spaniards. This portion equals the value of two grizzly bear skins, or three ponies, or the price of two wives. However it was *not* equally distributed any more than are riches in civilized communities—a point for communists to consider.

The shore tribes were the coiners of this money and jealously guarded their privileges . With it they bought skins, arms and implements from the dwellers in the Coast Range, where grew animals and materials not to be obtained along the beach. The mountaineers, in turn, disseminated it far in the interior, where finally the beads were prized and worn as ornaments, and ceased to circulate. Moreover, an enormous waste and destruction was always going on (a fact also true of the Atlantic coast) owing to the practice of propitiatory sacrifices, and the widespread custom of burying or burning all the wealth with each man (or noted woman) who died. Thus the demand was always greater than the supply, and a high value maintained. It is astonishing to read how shrewd and thrifty the Indians were in respect to this shell coinage. When Americans grew numerous and began to manufacture large quantities of the *hæwok*, of course its value declined; moreover, with the partial civilization of the Indians, a new sentiment crept in, and some strange changes in primitive social economy followed.

At present the younger English-speaking Indians scarcely use it at all, except in a few dealings with their elders, like wife-buying, or for gambling. A young fellow sometimes procures it as an investment, laying away a few strings of it, for he knows that he cannot squander it at the stores; whereas if he really needs a few dollars of current cash he can always "negotiate" his shells with some old Indian who happens to have gold or greenbacks. Americans speculate in it here and there to advantage, working upon the clinging love the aged savages retain for the wealth of their youth. These old men save all of it they can possibly acquire, and hoard it like veritable misers, only on great occasions letting their women-folk wear any as jewelry. This hoarding is not so much miserly greed, however, as it is a religious notion, since to their minds the shell-money is the only thing worthy to be offered upon the funeral pyre of any famous chief or departed friend, or sent along with their own souls into the spirit-world.

THE NATURALIST BRAZILIAN EXPEDITION.

Paper I.—From Rio de Janeiro to Porto Alegre.

BY HERBERT H. SMITH.

(Continued from page 358.)

ALL the hills in the immediate vicinity of Porto Alegre appear to be formed of granite or porphyry, but I had no opportunity to note the geological features closely. The strips of woodland which remain are less matted than the forests of Rio de Janeiro, and there are fewer vines and palm-trees; ferns are abundant, and we collected a score of species. One of the commonest birds here was a brown species allied to the thrushes, and called, *Joao de barro*—literally, clay-John. It owes this name to its singular nest, which is composed entirely of clay, and roofed over above; it is frequently placed in the most exposed situations, such as the tops of fence-posts, or the dead branches of trees. They are very tame, and I have frequently watched a pair of them at work. They bring the material, soft, unctuous clay, in good sized lumps, which they obtain near some water-course; these lumps, previously well kneaded, are laid first on the post or branch on which the nest is to be built, so as to form a foundation; each portion is well packed in with the bill, which is subsequently used like a trowel to smooth the surface. The sides are built up in the same way, the two birds working incessantly for several days; they seem to prefer rainy or foggy weather, when the wet clay can readily be found, and when the building is not hindered by the too rapid drying of the parts which are already finished. The nest, when completed, is nearly globular, seven or eight inches in diameter, and with walls an inch and a half thick; the cavity may be compared to a mold of a very crooked squash, the larger end forming the nest, and the smaller, turned downwards, the entrance. The clay soon becomes nearly as hard as brick, and the nests may last for many years, though I do not know that the birds use them more than once. In Rio Grande I found the birds breeding in June; three dirty white eggs are laid. This, or a closely allied species is found throughout Southern and Central Brazil.

A gallinaceous bird called *perdiz* (partridge) was also common on the grassy hillsides. Its plumage, prettily mottled with brown, is one of the best examples of protective coloration that I have

ever seen. It is paler on the back and dark beneath; seen at a little distance the spots resemble half-withered spikes of grass-seed mingled with shriveled leaf-blades; beneath and on the wings, the markings are nearly perpendicular, simulating stems and leaves. Even the shadows under a grass-patch are mimicked with marvelous fidelity. The bird, when approached, remains perfectly quiet, even allowing one to pass within two or three yards of it; and so perfectly is it concealed by its colors that we seldom noticed it until startled by its sudden flight, almost beneath our feet.

One day we hired a small boat, with two Portuguese oarsmen, to take us to some of the low islands in the river. We found that these were covered, in most places, with swampy forest of no great height, the trees resembling temperate rather than tropical species; there were no palms. These woods gave us a few good insects, and on the shallows near them we found many fresh-water Mollusca—Ampullarias, Anodontas and Unios. In one place we came across a fisherman's house—a mere shed of grass thatch, but serving as shelter for the man and his wife, and four or five babies with the least possible difference of age. One or two clay cooking-pots, a coffee-tin, a plate or two and calabashes for water, with hides to stretch on the ground for beds, constituted the entire property of the establishment, yet the inmates seemed happy enough, and they showed us such hospitality as was in their power. The woman brought us some wild honey, which I grieve to say had strong medicinal properties, at least to our unaccustomed stomachs. Travelers in Brazil should be very cautious about eating the honeys of the native bees; they often act as violent purgatives and cathartics, and some of them are decidedly poisonous.

The man readily consented to fish for me with his cast net, and he soon brought us quite a little heap of small fishes. Some species of Heros and Acara were abundant, as were several Siluridæ with thick, bony plates (Chætostomus, Loricaria). These "armor-fish" remind one of the old Devonian and Carboniferous ganoids, though they are not at all closely related to them. They are common in all the Brazilian rivers, living on the bottom, and sometimes burying themselves in the mud when the waters around them dry up; they will exist in this way, deprived of water except such as moistens the clay around them, for several weeks.

In their movements these Siluroids are very sluggish, and their scale-like armor seems to serve as a real protection against large predatory fishes and icthoyphagous birds.

Before going further it will be well to cast a general glance at the physical features of Rio Grande do Sul. Except the sand-banks and swamps of the lake-region, and some low alluvial lands near the River Uruguay, it may be said that the whole province is hilly or mountainous. The chains cross each other at all angles, and it would be difficult, with our present knowledge, to describe them in detail. In general the land is higher towards the north, and the extreme northern part of the province properly belongs to the great orographic system which lies between the Paraná and the Atlantic. This region is essentially a table-land, much broken and frequently obscured by chains of hills and mountains. Toward the ocean it is abruptly cut down, forming that great rocky wall known as the Serra Geral, Serra do Mar, or Brazilian coast range; to the west it falls gradually, or in a series of mountain terraces to the Paraná. Soon after entering the province of Rio Grande do Sol the Serra Geral bends away to the west, leaving the sea; beyond this the highland edge may be traced in a great curve to the valley of the Uruguay, but it gradually loses its distinctive character; the table-land is cut up by many rivers, and its outlines are lost among ranges of hills and mountains. One of these ranges, parting from the Serra Geral, passes southward through the middle of the province, separating the tributaries of the Uruguay from the streams which flow into the Lagoa dos Patos and the Lagoa Mirim.

Aside from these orographic features, the province is divided into two very distinct physical regions. The rugged northern portion is generally covered with forest, heaviest on the hillsides and along the river-courses, but in the main continuous. The climate here is warm during three-quarters of the year; cool and sometimes cold from May to August, when frosts are frequent and ice is sometimes formed; snow is almost unknown except on the highest mountains. Though this region extends in some places as far as S. lat. 31°, the plants and animals are essentially tropical, resembling those of Rio de Janeiro; palms and tree-ferns are abundant; monkeys and toucans are as common as on the Amazons; and brilliant blue Morpho butterflies, or long-winged Heliconii remind the entomologist that he is still in Brazil. In

the southern part of the province all this is changed. There nearly all the land is open prairie, only on the hillsides scattered bushes and low trees form a kind of pseudo-forest.

The climate here is colder and more variable; light snow-storms are common in the winter months, and the ground may remain frozen hard for days together. All this region properly belongs to the pampas of Uruguay and the Argentine Republic; the plants are generally of the same prairie species, and the animals are almost entirely identical. Monkeys, anteaters, tapirs and pacas have disappeared; in their places the naturalist finds deer with branched horns, foxes, armadillos and so on. Instead of parrots, toucans and trogons, there are hawks, ground-thrushes and ostriches; ground-beetles and yellow butterflies, much like those of our home fields, are seen everywhere.

The two regions are very sharply divided, but outlying portions of each are found within the boundaries of the other. On the top of the northern table-land, well within the limits of the forest region, there are extensive tracts of prairie-land; and some of the hillsides, even as far south as Pelotas (lat. 31° 45′) are covered with forest, which has much the same character as the main body of the north. In general, however, it may be said that the dividing line between the forest and prairie lies a little to the north of the River Jacuhy, the upper portion of the Guahyba, which flows from west to east near lat. 30°.

Of course the two regions differ much in their products. The northern portion, beside its forest industries, is the main seat of agricultural employments; the lands are fertile, giving excellent crops of corn, beans, mandioca, sugar-cane and tobacco. The prairie region is generally unfit for agriculture, and it is exclusively used for grazing, more cattle being raised here than in any other part of Brazil.

With the employments so the habits and characters of the people differ greatly. The men of the north are farmers, fond of their homes and seldom traveling far away from them; fixed to the soil by which they are nourished. In the south every laborer is a horseman, accustomed to ride for days and weeks over the hills, and spending very little of his time at home; he lives where his herd lives, eating his dinner of jerked meat and beans, and wrapping himself in his poncho to sleep wherever the night overtakes him. Ignorant in letters, he is wise in all that pertains to

his roving existence, despising his more laborious brother of the north. In disposition he is variable; the exigencies of his life have taught him to mistrust strangers, and his rough hospitality is generally guarded by a knife and pistol; so the farmer considers him ill-natured and blood-thirsty. On the whole the two classes have very little to do with each other.

But beyond this a very strong race-distinction has arisen, owing to the influx of German immigrants who have chosen the northern part of the province on account of its mild climate and fertile soil. Of the 700,000 inhabitants of Rio Grande do Sul about 110,000 are Germans or their descendants, and all except a few thousand of these are settled to the north of the River Jacuhy. These figures, however, do not at all represent the importance of the German element. It is the brawn and skill of the province; the element of progress, which is building up manufactures and doing away with the slovenly Brazilian agriculture; the commercial spirit which has given this province, with its one poor seaport, the most important trade south of Santos. The rich northern lands of the province are rapidly being taken up by German agriculturists, and their thriving plantations are seen on every hand. The grazing industry remains in the hands of Brazilians; it is still the most important pursuit of the province, the large amount of prairie land being favorable to it; but as a source of riches it is stationary, or perhaps decadent, the grazers being unable to compete with the great proprietors of Uruguay and the Argentine. The plantations, on the contrary, are yearly increasing in importance.

Porto Alegre owes its commercial importance almost entirely to the German colonies which have been formed in its vicinity. The first of these colonies, that of Sao Leopoldo, was established in 1823, soon after Brazil became an empire; this is now "emancipated," that is, freed from special government control, and it has become a flourishing city of nearly 5000 inhabitants. There are many other colonies, nearly all formed by German immigrants, and preserving the German language and customs; even in Porto Alegre one hears German spoken quite as often as Portuguese. With three exception all the wholesale commercial houses in the city are German, and their warehouses would do honor to any city. There are German retail merchants, physicians, lawyers, schoolmasters; the two most important news-

papers in the city are controlled by a German, who edits them equally well, one in German and the other in Portuguese. During our stay in the city a "German Exposition" was in progress, the articles exhibited being agricultural or manufactured products directly derived from the Germans of Southern Brazil; the display was an exceedingly good one.

The colonies are either public or private. In the former the immigrant is assigned a tract of land without payment, and he is under especial official control until such time as the colony is allowed to govern itself. The private colonies are the property of capitalists, who sell portions of land on credit, the payment being commonly in annual installments for five years. This has the advantage of giving the settler a choice of land, and of relieving him from annoying official supervision. Formerly the government paid the passages of immigrants destined for the public lands, but this plan has wisely been abandoned. Of late years the German immigration to this province has somewhat fallen off, and the Italian is taking its place; this is certainly a poor substitute, but it should be remembered that the Italians who come to Brazil are generally farmers or rural laborers—a very different class from the city refuse which goes from Italy to the United States. In Rio Grande do Sul the Italians are generally industrious and frugal, and they are well liked.

This is, perhaps, the only part of Brazil where immigration has been completely successful. The Imperial government has expended vast sums on colonization schemes, some of them visionary, others badly carried out, many doomed from the outset to failure, owing to the poor quality of the colonists. I believe, however, that the main obstacle to successful colonization has been the presence of the slave element and the consequent degradation of labor. An immigrant who has left Europe to better his condition will never be content to work beside an ignorant slave, much less if he himself is treated as an inferior, hardly better than the negro bondsman and only tolerated because he is a necessity. If he is established in a colony, with ground of his own to cultivate, he is still looked down upon by his richer neighbors because he does his own work instead of ordering servants; moreover, he is subject to unpleasant official supervision, and if he tries to escape this by buying a farm without the colonies, he finds that all the good land is absorbed in large plantations. In

Rio Grande do Sul, on the contrary, there are few slaves, and most of these are on the cattle-estates of the south. The free laborer is honored because experience has shown that his industry leads to wealth; there are few large estates, and land can always be purchased on favorable terms. Formerly there was much jealously of the foreign element, but this has nearly disappeared. Finally, the immigrant is contented and happy, because he can mingle with others of his own race, and because he knows that he is creating a bright future for himself and his children.

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THE POLAR ORGANIZATION OF ANIMALS.

BY CHARLES MORRIS.

IN previous papers by the writer under the title of "Organic Physics,"[1] certain fundamental characteristics of protoplasm were considered, and their relation to the functional conditions of the developed animal body traced. There are still other basic conditions in protoplasm which are directly related to the functions of the developed animal. There is no just reason to doubt, indeed, that each separate mass of living protoplasm generalizes in itself all that we find specialized in the highest animal, and that there is no condition unfolded in the man which does not exist potentially in the rhizopod. It is hoped here to show another of those interesting relations.

The self-living mass of protoplasm appears to be a polar organism in a double sense. It seemingly possesses a lateral or chemical polarity, which develops into the sexual polarity of animals. The self-division of the rhizopod is a reproductive function strictly analogous to that existing in the developed animal, and the sexual polarity of the former appears to be represented by a lateral sexual polarity in the latter, the two similar halves of the animal being the two poles in a complete double-sexed organism. This form of polarity has been considered in detail in the papers above referred to. But there is another polarity, which in the rhizopod displays itself in a differentiation of the exterior and the interior functions of the mass. The external region is sensitive, the internal nutritive in function. This statement has more in it than may at first sight appear, for it expresses an organic relation that con-

[1] AMERICAN NATURALIST, June, July and August, 1882, February and March, 1883.

trols the whole development of the animal kingdom, and is as strongly displayed in the man as in the protozoan. Both alike possess a distinct nutritive and sensory polarity, each of these functions having its separate pole.

This polarity is, in fact, particularly displayed in the fully progressed animal, as we shall hope to show. In its generalized condition, in the rhizopod, it consists of a differentiation of function in the two regions of the body. The external layer of the rhizopodal body alone comes into contact with and feels the impressions of outer force. Thus such sensitiveness as is possessed must be confined to this layer. The impressions received, however, seem to extend inwardly, and to result in the production of a motor function. The internal layer, on the contrary, is distinctly nutritive in function. The food is, in various methods, brought into contact with it, digested and assimilated. And as the sensory impressions received by the external layer are transmitted and produce motion throughout the entire body, so the nutriment received by the internal layer is diffused throughout and assimilated by the entire body.

At the very outset of life, therefore, a separation of its two active functions takes place as a necessary result of the opposed relations of its substance. The external layers of protoplasm become opposite in function to the internal. Contact, irritation, motor instigation, have their seat in the surface, and proceed inward. Nutrition has its seat in the interior, and proceeds outward. The development of the one tends to the production of special channels of sensory inflow, and special regions of motor contraction. The development of the other tends to the production of special digestive regions and special channels for the conveyance of nutriment. Thus the sensory and motor functions of the body originate in the surface and spread inward. Its vascular functions originate in the interior and spread outward. These separate functions are distinct only as regards their points of origin and their characteristics, for throughout the whole intermediate region they inosculate and interweave with each other.

The separation of functional regions, thus indicated in the Protozoa, is markedly displayed throughout the whole line of development of the Metazoa. In all the Metazoa an early step of embryonal differentiation is the formation of two distinct layers of cells, one bounding an internal cavity, the other forming a surface

layer. The former is the seat of the nutritive, the latter of the sensory function. Thus very early in life the animal possesses a digestive and a sensitive layer of cells. It is an animate stomach with a sensitive outer skin. There is no chemical differentiation of tissue. The duty performed by each layer of cells is a consequence of its position. The hydra, for instance, may be turned inside out, and the functions of the two layers become reversed without injury to the animal. In the higher animals, however, these two layers grow unlike in character and incapable of replacing each other. And yet in the highest animal there may be no fundamental distinction. Each layer gains special organs, which would not subserve the purpose of the other, but the character of their protoplasm may remain unchanged.

Between these two layers arises a third, the mesoderm, whose origin is yet somewhat unsettled, though there is no reason to doubt that it springs from one or both of the original layers. An examination of this mesodermal layer, from the point of view here taken, leads to certain interesting conclusions. For, in the highest animals, we find it to consist of several distinct tissues, which we may generalize into three. One of these is the nervous and its related muscular tissue. A second is the vascular and its related lymphatic tissue. The third is the connective or supporting tissue, with its various forms of fiber, cartilage, bone, &c. The mesoderm, then, seems to be a direct outgrowth of both the endodermal and ectodermal layers. The external layer pushes inward its channels of sensory inflow, which permeate every region of the body, each line of inflow terminating in a muscle, or motor organ. The internal layer pushes outward its channels of nutritive outflow, which permeate every region of the body, and as the nerves may be said to deposit their conveyed force in the muscles, so the vessels deposit their conveyed nutriment in the lymphatic assimilative spaces. This is really about all we find in the body, complicated as it may appear. If we consider its basic characteristics, we are brought back to the two original layers, or even to the external and internal regions of the rhizopod. As the body grows in bulk the external layer extends itself inward in a complex mass of nerve conductors, nerve cells and muscles. In like manner the internal layer extends itself outward, in an equally complex mass of blood channels and lymph vessels. So far, therefore, we have but the two primary layers, with their inti-

mately interwoven outgrowths. In the interspaces of these organs other matter is deposited, which serves for their support and forms the connective tissues.

Such is the true character of the mesoderm. The wall of the inner cavity becomes the digestive region of the body. It differentiates accordingly, involutions of it compose the various glands which aid digestion, and blood vessels which have their true origin in its walls, carry the nutriment which it yields to all parts of the interior. So the outer wall becomes the sensory layer of the body, and sends its nerve channels inwards to convey motor energy to muscles, which are, fundamentally, but special arrangements of nerve extremities. The mesoderm consists of these outwardly-pushing nutritive and inwardly-pushing motor channels, with the connective tissues necessary for their support. The remaining general function of the body, that of the elimination of waste and discarded material, is effected through the aid of both layers.

So far we discover in the highest animal only a direct unfoldment of what exists in the lowest. Protoplasm may be homogeneous in structure, and every portion of it at once sensitive to external contact and assimilative of nutritive material. But the different relations of its different regions necessitates an early differentiation of function. It becomes externally sensory, internally nutritive. And in the highest animals this differentiation continues. It is remarkably unfolded, but there is nothing added to it. Its original vagueness, however, becomes a marked specialization. We find in the simplest protozoan a double polarity vaguely declared. The first is a chemical or sexual polarity, in which the two lateral halves of the mass are concerned, and whose eventual result is the division of the mass into two vitalized halves. The second is a sensory-nutritive polarity, of which the external and internal regions of the body mass become the poles. Both these polarities are direct results of the native conditions of protoplasm and its relations to external nature. And in the highest animals we find nothing more than an extension of these differentiations of condition and function, and a more specialized display of these polarities. The sexual polarity seems to still affect the two opposite lateral regions, so that every animal, except as warped by the pressure of life conditions, is symmetrically duplex, the two similar halves being, as we believe, the male and female poles of a

double-sexed organism. In the higher animals a superior differentiation arises, in the division of sexual polarity between distinct individuals, yet its minor phase of the doubly-sexual organization of each individual, is still retained.

The other polarity of protoplasm mentioned is equally declared in the highest animals. As the former remains a lateral, this becomes a longitudinal polarity, as we shall seek to show. Originally it is a polar or functional difference of the external and internal layers. This distinction persists in the highest animals, but each of the two functions gains its distinct pole.

The pole of the sensory function is not difficult to discover. It becomes gradually declared as we ascend beyond the lower animals, and displays itself in all the higher animal forms as the brain. This organ is the center of the motor and sensory nerve fibers which collects, retains and again disseminates the impressions arising from external contact. Such an organ is perhaps not needed by lower organisms. Their defective sensory and motor organs render them but feebly sensitive to impression, and they can easily respond to every contact of sufficient vigor to overcome the sluggishness of their organs of sensation. But the whole course of development is towards a greater and more diversified sensitiveness of the animal form. The highest animals respond to impressions of excessive delicacy. Almost every force influence of the outer world is capable of affecting them, while their complex muscular organization permits of a great variety of responsive motions.

Yet evidently a movement in response to every impression, after such extreme sensitiveness is attained, would be decidedly injurious. The vigor of the organism would be exhausted. Thus with the increase of sensitiveness there became necessary the evolution of some discriminative organ, some center of sensation, in which the motor energies received could be retained, and from which the movements of the muscles could be controlled, only such impulses as were likely to be beneficial to the organism being permitted to pass onward. With the *modus operandi* of this process we are not here concerned. It suffices that a power of retention of and descrimination between nerve impressions became necessary ere any high development could be gained, and that the brain was evolved as the organ of this retention. The brain is, therefore, the true pole of the sensory function. Thither flow all

the motor energies received from the outer world through the nerve channels. There these motor influences are combined and retained, in some method which is yet a mystery, until the highly complex relations of the mental organism are produced. Thus the conscious mind is the final outcome and the highest product of the combination of motor energies, and the brain the governing organ through which the movements of the body are controlled.

But the nutritive function has likewise its organic pole, in which the final and highest product of its exercise is laid up. In "Organic Physics" this question has been considered. The building up and repair of the solid tissues of the body is only one of the results of the nutritive process. A second result we conceive to be the formation of the concreted portions of the liquid tissues—the white corpuscles or leucocytes. And the ultimate result of this process is the aggregation of the leucocytes into more and more complex corpuscles, until, in their final and most complex stage, they are excreted by the reproductive glands as the germs of new organisms. The formation of such a germ is the final outcome of nutrition. In this germ the organic product has reached its highest stage of synthesis. Chemical assimilation and molecular complexity have attained their ultimate, and the germinal cells exist as epitomes of the whole body. From this point of view the reproductive organs form the nutritive pole of the body.

Thus as the conscious mind is the highest product of the combination of motor energies, so the ovum or spermatozoön is the highest product of the nutritive energies. The latter represents the utmost reach of organic synthesis, and the former the ultimate of analysis. Nutrition, with its various results, is the agency employed in the one; oxidation, the agency employed in the other. Thus the two opposite processes to which life is due, nutrition and oxidation, has each its polar center, these poles being seated, at least in all the higher animals, at the opposite extremities of the body. We might, with some reason, proceed to consider the final result of the action of these organic poles. The nutritive germ ceases to be a part of the body which produces it, and is only temporarily connected with it for further nutrition and primary development. We may say the same thing of the mental germ, if we accept the belief entertained by the great mass of

mankind, and certainly not as yet disproved by the advocates of the opposite opinion.

We may further consider the relations of these two organic poles. The energies and substances organized in the body are not those which originally existed there. They are derived from the exterior world, and the body acts as a machine for their absorption and utilization. Food comes continually into the body, to be used primarily for nutrition, and ultimately for reproduction. Motor energy comes continually into the body, to be used primarily for animal activity, and ultimately for mental development. Thus from the outer world food and force, matter and motion, pour constantly into the body, where they are separately employed, and their excess directed to the two poles, food to the reproductive, force to the mental pole. At these two poles they are organized and exist as separate organisms, nourished by the body but not forming integral parts of it, the one fed with matter, the other with motion, and the body acting as an intermedium to absorb matter and force from outer nature, and apply them to the uses of its two diverse offspring.

The above consideration leads to still another. It has been frequently assumed that the animal body is organized solely under the influence of its external surroundings, and that its form is a result of a varied series of adaptations to outer conditions. But if our premises are correct there must be an inner force at work also, vigorously molding the body, and growing more declared and energetic as the animal reaches a higher stage of development. The rhizopod is not a mere creature of outer influences. It has, in virtue of the conditions of existence of protoplasm, the two polarities mentioned. Though acted upon by outer force, it reacts upon this force. Its lateral or sexual polarity controls the conditions and method of reproduction. Its motor-nutritive polarity controls the conditions of development. These influences act vigorously throughout the whole range of animal evolution as internal molding forces, resisting or directing the influences of the external molding forces. In the body of man, the highest animal, they have produced a remarkable double symmetry, which is strikingly indicative of its double polarity There is a lateral and a longitudinal polarity. The duplex paternal influence in the germ manifests itself in the mature body in a double organism, composed of two similar

halves connected in the median line. The longitudinal polarity is little less evident. The human body is an elongated, irregularly oval mass, branching at each extremity into limbs which are fundamentally similar. The body forms a hollow cylinder, being penetrated by a cavity which is devoted to digestion. Typically it is a symmetrical cylinder, but its internal symmetry has been broken by the requirements of the digestive function. The mesodermal arrangements do not detract from its symmetry. The bones and muscles answer to each other longitudinally. The excretory organs display a certain symmetry of arrangement, the kidneys for the excretion of liquid waste posteriorly, and the lungs for the excretion of gaseous waste anteriorly. Of the two remaining sets of organs, the vascular and the nervous, they seem, while generally related to the body as a whole, specially related to its polar regions. The vascular system, while engaged in the general duty of conveying nutriment and removing waste, has the special duty of elaborating germinal products and depositing them at the posterior, reproductive pole. The nervous system, while conveying motor influences to and from the tissues generally, is specially engaged in conveying motor impressions to the brain, the seat of the anterior or mental pole.

These poles answer to each other. They differ in organization from their great difference in use, but they are seated in the opposite extremities of the body, while the special sense organs are closely contiguous to the nervous pole, and the organs of food absorption lie in the vicinity of the reproductive pole. And as evidence that these poles are not directly but only secondarily concerned in the operations of the body, we have the fact that the cerebral and the reproductive organs may be both removed from the body, and its vital functions continue. In such a case there can be no reproduction, either mental or physical, no offspring, either spiritual or animal, yet the life of the animal as an individual is not necessarily affected, and may be long continued.

These parallels are, to say the least, curious, and they extend, though more or less masked, through the whole animal kingdom. But in the lower tribes the polarities have not yet become declared and localized. They are still vague and general, and have but a slight influence over the form of the body. Hence the forms of these lower animals are very largely molded by exterior influences. Their bilateral and their longitudinal symmetries are

but slightly or not at all displayed. In animals of somewhat higher organization, in which the polarities have become more localized, their effect upon the form is still largely masked by the influence of environing relations. Yet, though the poles assume unsymmetrical positions, the growing influence of the polar principle of organization is usually manifest. In the higher animal tribes the polar force asserts itself positively, and the result is a harmonious combination of functions arising from two sets of influences, those of external nature and those of the internal organic conditions. The formative energies inherent in protoplasm assert themselves against the irregular influences of the outer world, and produce in the highest animal a form of marked symmetry.

The polarity of the animal body is, in fact, fourfold in a somewhat fuller sense than here indicated. Each of the longitudinal poles is a double organ, so that each lateral half of the body possesses its longitudinal poles. And the brain of each half is directly connected with and controls the organic functions of the other half. There is thus a cross relation between the anterior and posterior poles. Each lateral half is, in a double sense, polar to the other half, and each may be looked upon as the representative of one of the parental organisms.

In the highest animals the action of the external forces must harmonize with, not oppose these internal energies. The polarities are not distinctly localized in the lowest animals, and there is little resistance to the action of external influences. The body is molded from without. But significantly, of the several lines of animal development, the vertebrate, that in which lateral and longitudinal polarity is most declared, has progressed far beyond the less symmetrical lines. With every step of development the influence of the polar tendencies grows more declared, while the molding agency of external force is more and more confined to superficial variations. In man the organization is markedly polar, and the molding influences of external nature are subordinate to the influence of the internal tendencies.

There is a minor phase of this organic polarity to which a brief allusion is desirable. In a former paper the influence of oxygen on the body was considered, and the relations of oxygenation and nutrition shown. Oxygen, in fact, is the servant of the motor function, and the constant foe of nutrition. From this

point of view it becomes interesting to find that the outer layer, the sensory region of the body, is the normal seat of ingestion of oxygen. This is particularly the case in the lowest animals. Food is ingested and dealt with by the interior substance of the body. Energy and oxygen, the agent of energy, are absorbed by the outer layer. This polarity of the function of oxidation is masked as that of energy grows strongly declared. The necessity of protection of the oxygen-absorbing tissue causes its inclusion within the body, though in the highest forms it retains indications of an invagination of the ectodermal tissue, as in the gills of fishes, and the lungs of land animals with their special nasal channel of external communication.

In one kingdom of the organic world, the vegetable kingdom, in which the sensory function fails to develop itself, the oxygenating function takes its place and becomes the anterior pole in a longitudinally polar organism. The symmetry of plants is, in this sense, closely analogous to that of animals. In all the higher forms of the plant world we find a cylindrical, elongated trunk with branching extremities. The two sets of branches are fundamentally identical, though they differ through the influence of functional differences. A tree, however, is a colony, and we must look upon the product of a single bud, with its cylindrical stem, its leaves and rootlets, as the individual vegetable organism. There is here no sensory pole, but there are analytic and synthetic poles. The leaves absorb oxygen, the rootlets absorb food. The former answer to the lungs, the latter to the intestines of animals. But as these functions are here complicated with, and subordinated to, no higher ones, they become the principal molding agencies, and the plant becomes a symmetrically polar oxynutritive organism. It probably possesses the double polarity which clearly exists in animals. The lateral, sexual polarity of animals seems to be replaced by a cylindrical polarity in plants, the inner and outer layers of active tissues which bound the sap channel perhaps possessing these opposite polarities. The other polarity, that of oxygenation and nutrition, is a longitudinal one; and thus the higher plant, as distinctly as the higher animal, is deeply molded by its internal constitution, and owes only its less fundamental, specific differences to the influence of external circumstances.

We need not carry this consideration further. It certainly

seems evident that the animal body is fundamentally molded by the energies of a double polarity, the one arising from the chemical character, and the other from the physical relations of protoplasm. The influence of external energies, strongly declared in the early phases of animal evolution, becomes less and less declared as the polar energies assert themselves, so that eventually the action of external force is confined to producing the minor, specific differences of organization; while the deep-lying, typical characteristics of organic form are due to the action of the polar energies.

And the character of the polarity specially referred to in this paper may be thus epitomized. Nutrition is primarily devoted to the growth and preservation of the individual animal, while its excess or overflow is directed to the reproductive pole, where it yields the germ of a new animal. Motor influence is primarily devoted to the vitality and activity of the individual animal, while its excess is directed to and retained in the sensory pole, where it forms the germ of a mental organism. The one flows posteriorly, the other anteriorly to their respective poles. The material germ is more matter than energy, the mental germ more energy than matter. The one is the ultimate of material or chemical complexity, the other of motor complexity. As compared with each other we may look upon the material germ as possessed of maximum matter with minimum motion; and the mental germ of minimum matter with maximum motion; their essential difference consisting in the complexity of material aggregation in the one, and of motor aggregation in the other.

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NOTE ON THE CLASSIFICATION OF MOTHS.

BY A. R. GROTE.

WHEN we take a general survey of the different classifications proposed by authors, we must be struck with the different ideas expressed with regard to the composition of families and sub-families. At a glance we see that the sub-families of the Bombycidæ and those of the Pyralidæ (as the last are arranged in the "New Check List") have a higher value than the divisions of the Noctuidæ and Geometridæ, as adopted by Guenée and Packard. They rest on peculiarly strong structural grounds,

having exclusive characters, and hence the effort of late to break up the Bombyces into distinct families. Thus disassociated, the general character of "form" as laid down by Agassiz neglected, the next step is to force them into unnatural positions, to displace the Hepialinæ, and rank them with the Castnians, or to produce such an arrangement as Von Heineman proposes. The "sub-families" of the Noctuidæ are, on the other hand, vague, and they shade into each other, in such a way, that it becomes a matter of choice where we assign the limit. The difficulty lies mostly with the Noctuidæ. Two groups, Bombyciæ and Noctuophalænidi, possess exclusive characters which have led to their being treated as distinct families by the German entomologists. In form these two small groups are decidedly noctuidous. The one closely resembles the higher, the other the Catocaline group of the Noctuidæ. Certain general assemblages, such as the Bombycoidea, Hadeninæ, etc., are, in a general way, admitted by Lederer, but he denies them a scientific basis, and discards them in the body of his work. Excluding the two groups above noted, he has no division of the family at all higher than a generic one. The same is true of Geometridæ, although here the divisions show more character. In the Pyralidæ, however, the sub-family groups are again strong. The existence of these sub-family groups are, perhaps, dependent on the general question of the development of the sub-order. The intermediate groups have fallen out and ceased to be perpetuated.

There is a certain parallelism between the Sphingidæ and Noctuidæ, apart from their usually naked larvæ, the hairy larvæ of the higher Noctuids having a Bombycid analogy which Butler recently regards as a real affinity.

The most natural classification of the Noctuidæ, seems to me yet that proposed in my "Check List of 1876," where I recognize three sub-family groups, the Noctuinæ and Catocalinæ of Dr. Packard and the Deltoides of Latreille; considering the other two groups, above mentioned, as having a higher than sub-family value. The difficulty lies in the existence of groups intermediate between family and sub-family divisions as hitherto assumed. In weighing the characters, the different values between these groups become apparent. Our terminology will have to be extended; but before this is undertaken, more precision must be attempted with the terms we have on hand.

With the Noctuidæ comparatively sharp division may be attempted between the Noctuinæ and Catocalinæ, yet an observer such as M. Guenée classified a catocaline form as a species of Heliophila, and I believe that an insect allied to Ophiusa has been recently described as a species of Tæniocampa, illustrating the difficulties of the task. The Deltoids, on the other hand, slide imperceptibly into the lower Catocalinæ. Here the tropical forms are so numerous and diverse, that the links seem yet existing and the value of this division is thus lowered below that of the two others. Yet the extremes, such as Catocala and Hypena, are readily distinguished.

I would regard the Bombycidæ in the light in which I gather the group is held by Dr. Packard, as a family of moths of ancient origin, and which, as it survives to-day, affords numerous synthetic sub-family groups, which should not be divorced from a family association; its classification may be considered as typical of the arrangement of other groups of moths. Starting with ideas derived from a study of the Bombycidæ, we shall be better prepared for an appreciation of the relationship existing between other groups of genera in nocturnal Lepidoptera. In the classification of the Noctuidæ it would seem best to hold a position intermediate between that of Guenée and Lederer, in order to avoid, on the one hand, the formation of sub-family groups which rest on slight characters and, on the other, to insure the recognition of the break which probably exists between the groups first indicated under the names of *Noctuæ nonfasciatæ* and *Noctuæ fasciatæ* by Borkhausen. The difficulty of studying the Noctuidæ is increased by the number of forms inhabiting North America and the other continents. Twenty-five years ago we had no more than a dozen species mentioned in our books, now we have about sixteen hundred. The number grows at the rate of from fifty to one hundred every year, as Western collections are received. They contain also structural forms which tend to break down the ideas of sub-families derived from the study of the European fauna alone. We have such a genus as Trichorthosia, for example, which, to the appearance of Orthosia, has the hairy eyes and untufted abdomen of Tæniocampa and the spinose tibiæ more especially characteristic of the genus Agrotis.

HETEROGENETIC DEVELOPMENT IN DIAPTOMUS.

BY C. L. HERRICK.

(Continued from page 389.)

CYCLOPS INGENS Herrick (*Cyclopidæ* of Minn., p. 228, Plate IV, Figs. 1–8).

Found in pools near Tuscaloosa, Ala., with *Daphnia pulex* and *Simocephalus daphnoides*. The post-imago is somewhat over $\frac{1}{10}$ in. long, *i. e.*, not quite as long as *C. gigas* according to Brady, which is very little different. Our form has longer stylets and shorter antennæ in the ordinary stage, but the mature or post-imago has shorter stylets. In the last stage prior to maturity the stylets are just as figured by Brady for this stage. It is worthy of remark that *C. kaufmanni* Uljanin, which is certainly founded upon a prematurely gravid larva (feet being 2-jointed and antennæ undifferentiated) corresponds perfectly with larvæ of *C. ingens*.

Brady himself considers *C. helleri* the same species, and we have here apparently an older stage with fully developed feet but not yet provided with mature antennæ.

A variety of *C. ingens* is found in cold springs at Tuscaloosa and elsewhere in Alabama, much less in size and with the proportions of the European *C. gigas*.

The large examples in shallow "prairie pools" were masked by dense algæ coating. The form of the fifth foot and stylets distinguishes the above from other members of the genus, and one is tempted to regard these forms as varieties of *C. gigas* simply. *C. parcus* (Cyclop. Minn., p. 229) might be considered a var. of *C. ingens*.

CYCLOPS PECTINATUS, sp. nov. (Plate VII, Figs. 25–28).

Related to *C. navus*, from which it is chiefly distinguished by a semicircular series of small spines at the base of the greatly elongated caudal stylets. In the post-imago the stylets are nearly half as long as the abdomen; the antennæ reach nearly to the base of the third segment. In the ordinary adult the stylets are less elongate. In all forms the lateral setæ are one-third from the end and the outer and inner terminal setæ are short spines; the fifth foot is as in Navus and the operculum valves is a little different. Most characteristic, however, is a circlet of small spines one-fourth from the base of the stylets. Length over $\frac{8}{100}$ in.

CYCLOPS TENUISSIMUS, sp. nov. (Figs. 24–25, Plate V; Figs. 20–21, Plate VI).

Section with 17-jointed antennæ.

Extremely elongated; antennæ reaching a little beyond the first thoracic segment, short jointed, formula — ⏑ ⏑ — ⏑ ⏑ — ⏑⏑⏑⏑⏑⏑⏑ ⏑ ⏑ ⏑, the terminal joint rather short, armed with three teeth near the extremity; antennules rather long, last two joints slender; fifth foot 2-jointed, second joint with two nearly equal setæ; cauda stylet, as in *C. tenuicornis;* opening of spermathæca elongated.

This species is the most slender Cyclops known to me, and may be recognized by the toothed terminal joint of the antennæ, a character otherwise confined to *C. tenuicornis*, "coronatus stage."

The teeth of this species differ from those of "Coronatus" too much to confuse the two. This species is of the *navus* and *parcus* group, but the caudal stylets closely resemble *tenuicornis*. Near Paducah, Ky.

CYCLOPS MODESTUS, sp. nov.

Antennæ remaining 16-jointed in all individuals seen, very short, formula — ∪ — ⊻ ∪ — ∪∪∪ ∪ ∪∪ ∪⊻ — ∪; antennules short jointed; fifth foot three-jointed, with unequal spines; caudal stylets of moderate length, lateral setæ about half way to base of stylet, three longest terminal setæ subequal.

This is a small species related to the preceding, but differs in many respects, the form of the spermathæca is oval. The egg sacs are slender, elongate oval. Cullman county, Ala.

POST-EMBRYONAL DEVELOPMENT OF TWO SPECIES OF DAPHNIA.

In a previous paper it was shown that the spine found on the posterior portion of the shell in young and male individuals, in all members of this genus, is a persisting embryonal character, and its possible advantage to the economy of the animal was pointed out. It was indicated that a recognition of the facts brought out, would throw several species into synonymy. It is my wish, in this paper, to illustrate the extent of the variations passed through in the course of later development, by two examples, one of which has been but imperfectly described, while the other is new to America.

These two species differ from any known to me, though they may possibly be found among some of Sars' numerous nominal species.

DAPHNIA LONGISPINA Herrick (Microscopic Entomostraca, 1877).

This name was applied to the young, and in connection a figure was given of a male with the spine on the head which, in the female at least, was indicative of immaturity. The name is not particularly appropriate, for the mature female is not evidently spined.

This name has been long applied to another form in Europe, but apparently to an immature stage of another species, so that it is really vacant.

In a paper (Notes on Cladocera of Minnesota) in the Rep. of Geol. Surv. of Minn. 1881, the post-imago is figured, and a variety of the younger stage (a little distorted in the molt). I am now able to complete the chain from the embryo to the post-imago (see

Plate VII). Fig. 3 is the embryo extracted from the brood cavity, showing that the eye is near the extremity of the elongated head even before the two eye spots have united (Fig. 10). Fig. 2 shows the early stage of post-embryonal growth. Fig. 1 is the adult in the first stage in which all the peculiarities of the species are pronounced. Fig. 4 is the post-imago (see also Plate XI Figs. 15–16 of Notes on Minnesota Crust., and Fig. 4 in the text).

DAPHNIA DUBIA, sp. nov.?

This species is very nearly related to the preceding, differing, however, in having the eye small and situated nearly in the center of the head, while the previous one has an eye of usual size and near the straight lower margin. The head is much more acute than in the preceding but not carinated (Fig. 9). Both these species have occasionally a horn in young stages (Fig. 14). The claws are smooth or simply pectinate. The spine in the latter species is more elevated. It is remarkable that the same species has both forms of abdominal appendages represented at Figs. 13 and 8.

The post-imago of *dubia* has not been seen. The nearest approach to it had a considerable spine, but the head had already begun to assume the shorter form with a curved lower margin.

The only allied species yet described from America, is *D. lævis* of Birge in which the development is tolerably well completed.

By filling up the gaps till all the stages in each case are known, we have advanced one step toward an accurate determination of species, and require then to learn what variations in the process usually obtaining may be occasioned by alterations in the environment. But in the mean time we are discovering the laws which govern development and the historical affinities of the different genera and species.

DAPHNIA PULEX.

This common species is subject to variations which are perplexing, but there seems to be no reason for the separation of the var. *denticulata*, as done by Birge. The differences relied upon are the fine teeth down the claw and the abrupt curvature of the lower margin of the head. Fig. 4 of Plate I in P. E. Mueller's work figures this peculiarity of the claws. Quite typical *D. pulex* from Tuscaloosa, however, do not have the fine teeth and only 12–15 teeth on the abdomen.

SCAPHOLEBERIS ANGULATA, sp. nov. (Figs. 26–28, Plate V).

The genus Scapholeberis at present consists of two species, *S. nasuta* Birge,[1] and *S. mucronata* with its three varieties *(a) fronte lævi, (b) fronte cornuti* of Europe, and *(c) armata*,[2] found in Minnesota, Illinois and Tennessee. With regard to the European varieties it is remarkable that although they are not local varieties,[3] the horn upon the head appears in the larger individuals and not as would be expected from the analogy of Daphnia, in young and small individuals. However, it is to be noticed that the spines of the valves in Scapholeberis are not persisting embryonic characters like the spine in Daphnia, but the young are like Ceriodaphnia. It may be that in like manner the crest upon the head in Scapholeberis is, instead of an embryonic appendage as in Daphnia, a later production. It might then be suggested that Scapholeberis is now undergoing differentiation or, in other words, is a new genus historically, while Daphnia is past the acme of its activity in the direction in which it has differentiated, and now retains its peculiarities by inheritance, and tends to continue them only so far as they are of functional value.

The horn which sometimes appears in young of certain species of Daphnia (*D. galeata*) and seems so capricious in its production, may be not unlike that of this species.

Were it not that *S. mucronata* is known to be very variable, it might be admissible to create var. *armata* a new species. Additional details are given for this variety in Figs. 23–24, Plate VI.

Scapholeberis angulata, sp. nov.—Head of medium size; rostrum directed downward and backward; eye of moderate size; macula nigra indistinct; formices and basin for antennæ well developed; antennules long curved, armed with two lateral sense hairs as well as the terminal olfactory ? filaments; cephalic portion of the basin of antennæ marked by longitudinal lines connected at intervals by cross lines, inferior portion of the part of the basin on the valves reticulate; "mucro" absent, the inferior posterior corner of shell simply sharply angled; inner wall of shell furnished with a row of small spines below and posteriorly for a part of the height of the shell; caudal teeth 5–7 in adult, being more numerous than in any other known species; size large.

The "mucro" is absent in the smallest individuals seen. Scapholeberis seems to lie between Daphnia and Ceriodaphnia, agreeing with the former in being a divergent member of the family, but still with more affinities to the latter. Near Decatur, Ala.

[1] Birge. Notes on Cladocera.

[2] Herrick. Notes on Crustacea of Minnesota, Geol. Rep. 1881.

[3] Kurz. Doclekas neuer Cladoceren, etc., p. 22.

SIMOCEPHALUS DAPHNOIDES, sp. nov. (Figs. 30, 31, Plate V; Fig. 16, Plate VI).

Four nominal speeies of Simocephalus are deseribed: *S. vetulus* Müller, *S. expinosus* Koch, *S. serrulatus* Koch, *S. americanus* Birge. The differences in some cases seem quite trivial, since the form of the *macula nigra* certainly varies with age along with the shape and armature of head and the general shape of the body. However, the present species is so unmistakable that it is not requisite to enter upoa a discussion which lack of material makes undesirable.

Simocephalus daphnoides, sp. nov.—General shape very like Daphnia; head regularly curved and not strongly angled in front, not marked off from the body by a strong depression; eye of moderate size, macula nigra oval to rhomboidal; antennules long curved; anterior portion of shell as deep as the posterior; the three curved spines at the lower posterior angle of shell are wanting; abdomen much as in *S. vetulus*; claw fringed part way with weak spines.

This species is recognized by its oval shape and the Daphnia-like shape of head. In old females the spine is about midway of the depth of the shell, but the upper outline is regularly curved and not keeled as in *vetulus* (Fig. 29, Plate V). Quite characteristic is the absence of the three or four curved spines on the shell angle (comp. Fig. 31 with 29*a*). On the whole in this species an approach to Daphnia may be seen. Near Decatur, Ala., with *Scapholeberis angulata*, also in all Southern Alabama.

CERIODAPHNIA ALABAMENSIS, sp. nov. (Figs. 11–12. Plate VI).

Ceriodaphnia is a very perplexing genus, and one in which the effect of age has not been studied. Three species have been mentioned from America, *C. cristata* Birge, *C. consors* Birge, and *C. reticulata* (= *dentata* Birge), there remaining *pulchella*, *rotunda*, *punctata*, *laticauda (?)* and *quadrangulata*, as described in Europe.

Quite typical *C. reticulata* were collected back of Paducah, Ky. The peculiar shape of the fornices figured by P. E. Mueller can be produced by pressure. I have little doubt that this is the same animal described from Massachusetts and Wisconsin by Birge. The head is not so suddenly angled behind the eye as figured by Birge, but more so than represented by Mueller.

C. alabamensis, sp. nov. — The form for which this name is offered, is known from a single gathering at Tuscaloosa, Ala., but it differs from any known species so much as to leave no

doubt that it is a new species. A complete diagnosis unfortunately cannot be given.

Head remarkably small and produced downward; eye very small; the head extends into a beak-like prolongation below the eye; the antennules are very long and pendant as in Moina; the body is longer than in *reticulata*, and the reticulations have a double contour line as in *C. pulchella*; the abdomen is slender and the sides nearly parallel, the claws being short and truncate, the spines of the usual size. Two summer eggs were in the cavity of the animal figured.

A fifth species of Ceriodaphnia was found in cold springs near Tuscaloosa, Ala., which is not greatly different from *C. reticulata* as defined by P. E. Mueller and Kurz.

CERIODAPHNIA (*reticulata* var.) PARVA, sp. (vel var.) nov.

$\frac{22}{1000}$–$\frac{25}{1000}$ in. long, transparent; head not strongly depressed, somewhat abruptly angled in front of antennules; fornices not very prominent; antennules short, conical, shell oblong, ending in a sharp angle posteriorly, simply reticulated; abdomen rather short, not narrowed very much, distally rounded at the extremity; claws rather short, smooth, spines short curved.

This very small species was found in considerable numbers, but very little variation in size was noticed. *C. pulchella* Sars, is 0.5–0.6^{mm}, but the head is quite different, though the abdomen is similar. Kurz says also, "Die schalensculptur ist doppel-linig," which is not the case in our species.

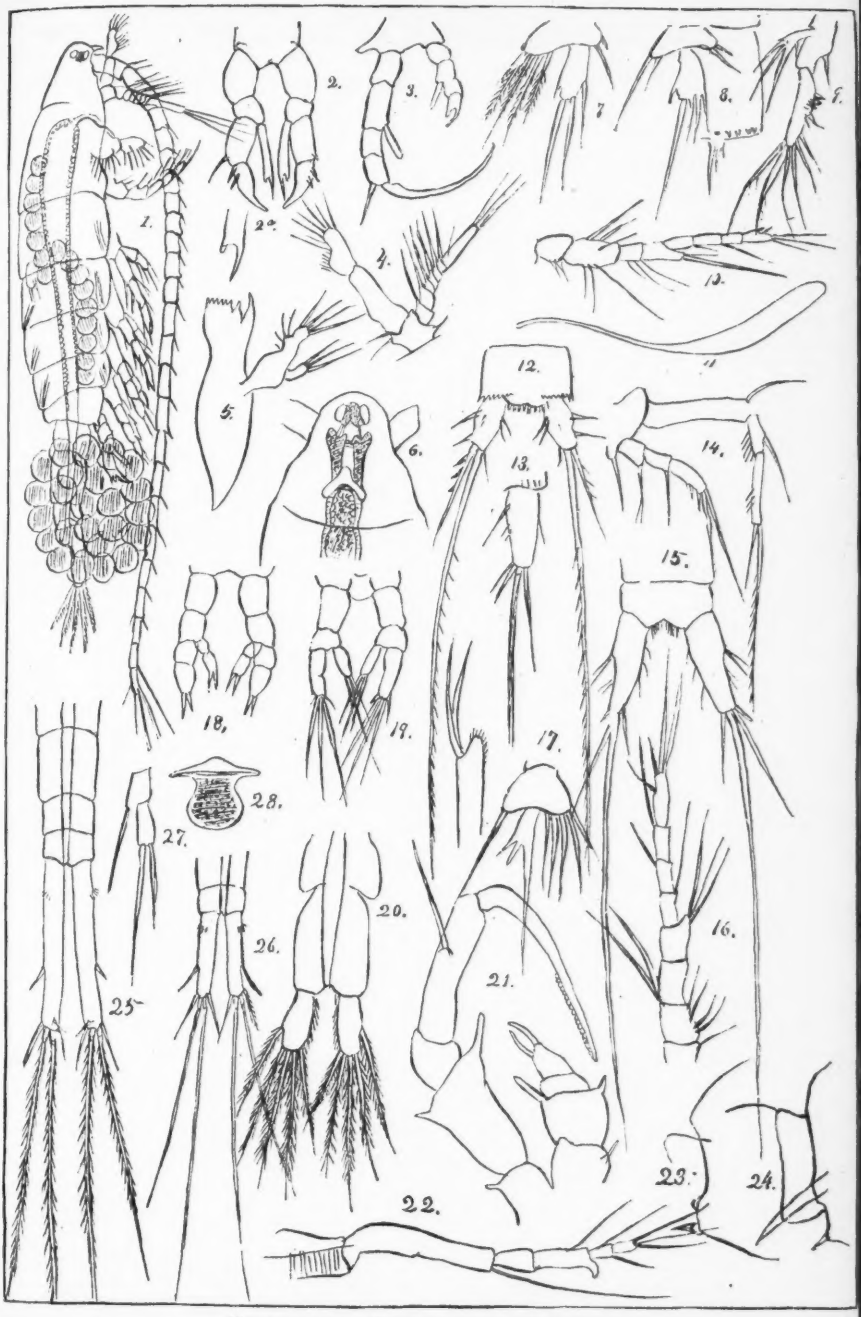
C. quadrangula is 0.6^{mm}, but several important differences are observable between the two species. In that species the head is said to be "valde depressum, ante basin antennarum ferme non angulatum;" the antennules are large and the abdomen narrow.

In general appearance this species is a reduced copy of *C. reticulata*, but the claws are smooth. Kurz speaks of a small var. of *reticulata* with smooth claws, but the fornices are then said to be sharp.

EXPLANATION OF PLATE VII.

FIG. 1. *Diaptomus pallidus*, female.
" 2. " fifth feet of female.
" 3. " fifth feet of male.
" 4. " antennules.
" 5. " mandible.
" 6. " head.
" 7. *Canthocamptus*, sp. n. ? fifth foot of female.
" 8. " fifth foot of male.
" 9. " antennules.
" 10. " antenna of female.
" 11. " spermathæca.
" 12. " stylets of female.
" 13. " stylet of male.
" 14. " maxilliped.

PLATE VII.



HETEROGENETIC DEVELOPMENT IN DIAPTOMUS.

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FIG. 15. *Canthocamptus*, sp. n., stylets of female.
" 16. " antenna.
" 17. " fifth foot of female.
" 18. *Diaptomus* "*sanguineus*," fifth feet of larva (♂).
" 19. " fifth feet of larva (♀).
" 20. " abdomen of larva (♀).
" 21. " fifth foot of adult (♂).
" 22. " antenna of adult.
" 23. *Diaptomus* "*castor*," margin of last segment (♂).
" 24. " margin of last segment (♀).
" 25–28. *Cyclops pectinatus*.
" 29. *Diaptomus pallidus*, inner ramus of fifth foot (♀.)

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REMARKS ON THE MORPHOLOGY OF ARTERIES, ESPECIALLY THOSE OF THE LIMBS.[1]

BY FRANK BAKER, M.D.

IT is generally taken for granted that the variability of arteries is such that they are of but little use in morphological studies. Anatomists are usually of the opinion that since the function of the arteries is to nourish the tissues, their course from the heart to their destination is of too slight importance to the race to have become a fixed character, and all search for law is abandoned. But it is questionable whether some biologists have not too hastily come to this conclusion.

Morphological laws are always obscure when studied in the adult individual alone. To trace them we must examine the different phases of individual development and investigate the anatomy of related forms.

There is a period when the embryo of a vertebrate animal is not provided with a proper vascular system. During the early stages of the segmentation of the ovum, no vessels exist, the young cells receiving the necessary nutriment from an interstitial plasma, as do those of the lowest Protozoa.

This stage is of short duration. Throughout the minute disk-shaped object which is hereafter to be a fully developed vertebrate, certain cells appear, of a slightly reddish color, dotting the disk in a peculiar marbled manner. From their appearance and isolation these are known as *blood-islands*. They touch each other finally as they increase in number, either at some part of

[1] Abstract of a paper read before the Montreal meeting of the Amer. Assoc. for the Advancement of Science.

their contour or by means of processes which they throw out, so that there results a net-work, at first indistinct but gradually increasing in clearness and color as the cells enlarge.

Each of these blood-islands then undergoes vacuolation, a portion of the protoplasmic contents becoming liquified and leaving a cavity. By a budding process new cells are formed in the interior of the mother-cells and becoming detached float free in the fluid which fills the vacuole. At this period, therefore, the blood-islands present an outside cell-wall with a contained fluid in which float free cells or corpuscles, the whole arranged in a close mesh-work.

Next the cell-walls wherever in contact thin away and disappear, there resulting a tube the walls of which are the original cell-walls of the blood-islands, the contents a fluid, plasma, in which swim free blood-corpuscles. There is at first no special difference in size among the vessels thus formed, nor is there any structural difference by which we can distinguish arteries from veins. No trunks or branches can as yet be made out, it is in fact a *capillary plexus* that appears, all vessels lying on the same plane and communicating equally with each other.

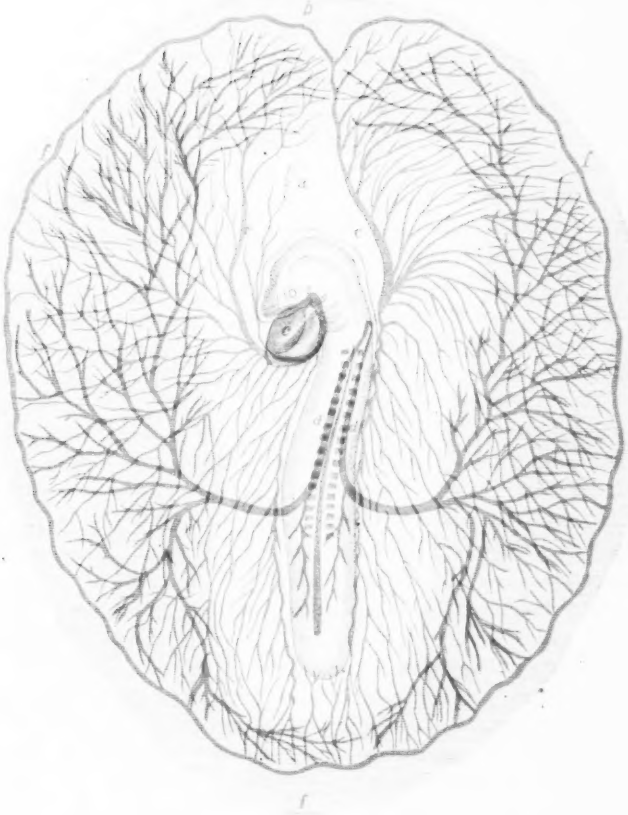
But a difference soon begins to be manifest. The rapidity of growth varies greatly. Along certain lines the vessels begin to increase in size so that soon there is visible distinction of capillaries, branches and trunks. This process of capillary and trunk formation extends from without inward, attains the proper body of the embryo, finally reaching the rudimentary vesicle which represents the heart. (Plate VIII.)

It should be noted that the development is *centripetal.* Nothing is more natural than to look upon the arteries as a system proceeding *centrifugally* from the heart outward.

However convenient this may be to the physiologist or the surgeon, to the anatomist it embodies a fallacy. The capillaries are the first formed, next the arterioles, then the branches of larger size, finally the trunks. It is owing to the subtle persistence of this fallacy that the study of the arterial system has advanced no farther.

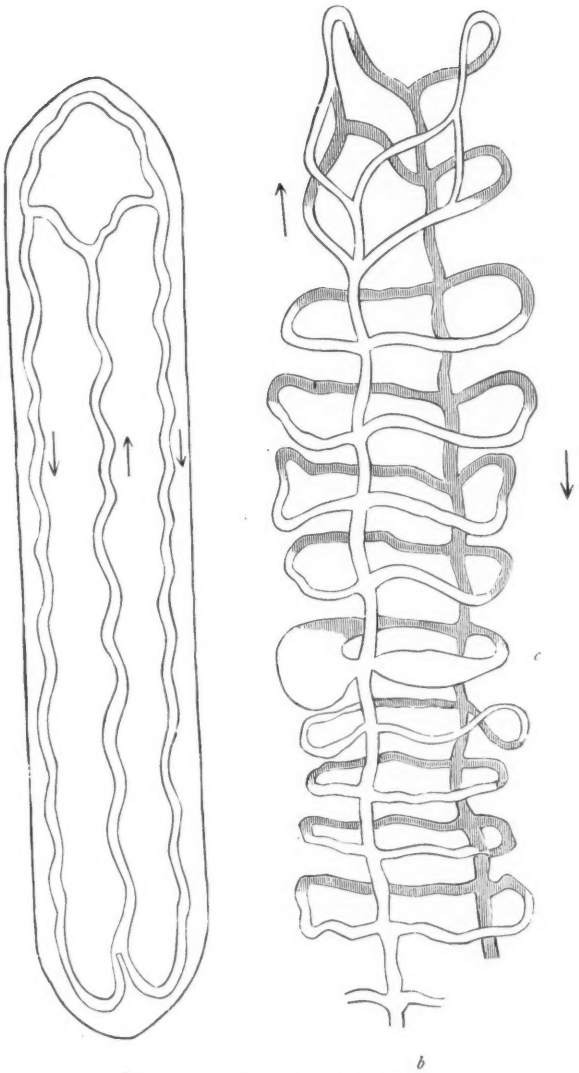
I have mentioned that the rapidity of growth is greater along certain lines, thus leading to the formation of trunks. It is conceivable that these trunk-lines should be intermediate in direction, but in fact they usually become established in certain definite situations. What can be ascertained as to the causes for this?

PLATE VIII.



CIRCULATION IN THE EMBRYO.

PLATE IX.



a *b*

CIRCULATION OF VERMES.

We get but little information on this point from the embryo. It will therefore be necessary to examine the vascular system in those animals along which we suppose the line of descent to have passed, getting thereby a fuller history of the successive stages than we can do in the condensed abridgment shown us in embryonic life.

Not until we reach worms do we find the commencement of a true *blood-vascular* system. It is true that even Amœbæ have a trace of vessels formed by the coalescence of vacuoles arising at indeterminate points in the protoplasm, but these are not permanent. In Vermes we have, formed within the layers of the mesoblast, permanent vessels having walls and independent of the body cavity.

In the simplest form we have three longitudinal trunks, two lateral, the third medio-dorsal. Simply connected behind, toward the cephalic end they are somewhat coiled around the ganglionic center which represents the primitive cerebrum, distantly reminding us of the branchial arches of vertebrates. In some genera transverse vessels connect these. This is more distinctly shown in the ringed worms where a distinct transverse trunk exists for each segment of the body. Some portion of these vessels may become pulsatile, sometimes a transverse vessel, sometimes a dorsal one. This is the primitive heart, originally a portion of the tubular system which takes on contraction. (Plate IX. figs. *a*, *b*, *c*.)

Doubtless trunks were originally developed for the reason that fluids will move more rapidly and effectively through a large straight vessel of uniform size than through a capillary network. As these worms move their bodies longitudinally, mechanical force acting on the blood would tend to enlarge the capillaries in that direction.

As to the formation of lateral trunks, it will be noticed that each corresponds to an original segment or somatome of the animal. Each of these somatomes is to be considered morphologically as a semi-detached individual, having its own special nervous system and muscles. Hence each has a semi-independent center of nutritive activity and a lateral trunk for ready and effective supply. Vertebrate animals, including man, share with these lowly organisms this peculiar ramification. The aorta gives off the intercostal arteries which pass around the body and connect with other longitudinal vessels (internal mam-

mary and epigastric). In the lumbar and sacral regions a similar arrangement can be made out, somewhat obscured by the modifications of the abdominal wall. This gives strong support to the theory of the segmentation of the human skeleton. (Plate X.)

What can be said as to the limb-trunks? Let us examine their plan. It will be observed that their bifurcations have a definite relation to the segments of the body. Thus for the pelvic extremity we have first, at the sacro-iliac joint, a division of the common iliac into internal and external iliac; below the hip-joint the main trunk divides into superficial and deep femoral; below the knee another bifurcation gives us anterior and posterior tibial; on reaching the foot there is a division into external and internal plantar, whence radiate branches to the toes.

In the thoracic limb a similar law can be discovered, although the enormous preponderance of the cephalic extremity modifies the vascular supply. The subclavian gives off the thyroid axis after passing the sterno-clavicular joint; the superior profunda represents profunda femoris; the next bifurcation is into radial and ulnar; then the division of ulnar into deep ulnar and superficial palmar arch, whence digital branches. Here again we have a dichotomous division corresponding to segments of the limb, the main trunk dividing after passing the joint.

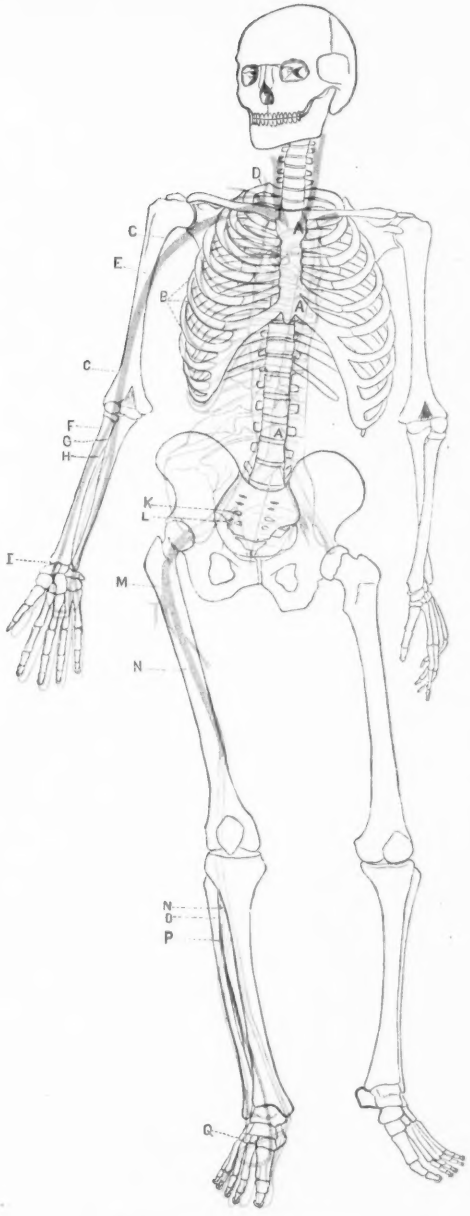
As far as I am aware no attempt has been made to explain this law morphologically. The conditions of nutrition might be met by a single axial trunk extending from the aorta to the phalanges giving off branches irregularly.

If it is urged that simplification of trunks is desirable near movable joints, the numerous examples of high division show that the advantage is not great.

The existing attachments of muscles might be adduced as causing the peculiarities in the vessels. It is true that the deep muscles are segmented in accordance with the divisions of the limbs, but the superficial layers frequently extend from one segment to another or even to a third. Besides, this segmentation also requires explanation, and it is conceivable that it may depend upon the same causes that affect the bifurcation of the arteries.

May it not be possible to explain the division of the limb-arteries by deducing a general law dependent upon some antecedent morphological condition? The arteries of the aortic arch

PLATE X.



CIRCULATION OF THE ADULT.

though greatly variable and complicated in their origin, have been beautifully explained by Räthke and his successors by reference to a general plan of branchial arches, a plan nowhere completely realized, but approximated more or less closely.

If we, in like manner, go back to the primitive limb, we have, according to Gegenbauer, and others, a central stem along which are developed radiate elements at regular distances, each element arising at or near a joint. In the limbs of the higher vertebrates the number of rays is reduced, those on one side being entirely suppressed.

A discussion of the subject would be foreign to the purpose of the present paper. I only wish to point out that the ramification of limb-arteries affords the theory some support. For each original ray would have its separate trunk, and at the convergence of the rays these would fall into an axis trunk. Suppress the rays of one side and a regular dichotomous division remains. Proceed farther and gradually suppress those of the other side and we might expect to find traces of those latest suppressed in small trunks supplying new structures which came to be formed, having as an indication of their radial character an origin not far removed from the point of segmentation of the limb.

If this is a proper view the internal iliac and profunda femoris in the lower limb, the thyroid axis and superior profunda in the upper may be considered as arteries originally belonging to independent rays now aborted. Of the same category are the interosseous in the arm and the peroneal in the leg.

The operation of this law, if it be such, is obscured in some cases by the formation of anastomoses crossing from one ray to another at the points of segmentation. Thus arise the palmar and plantar arches formed below the carpo-metacarpal and tarso-metatarsal joints.

It is also obscured by the operation of two laws derived from the centripetal development of the vascular system. The first of these may be called *variability of convergence.* If some cause slightly diverts a forming trunk from its normal course, the deviation would increase in proportion as it approached the heart, the trunk would debouch at an unusual point and this would cause what is known as an abnormal origin for the artery.

The convergence may be more or less than normal. If more, the origin would be farther from the heart; if less, nearer. When

the arteries of the limbs vary in convergence it is usually a defect, and the bifurcation is, therefore, nearer the heart. The brachial artery divides normally just below the elbow joint, cases of a lower division are so rare that Quinn found but one in 481 cases, and that doubtful because complicated by other anomalies. The same law hold good for other arteries. Now, if the normal point of division is to be considered as the *nodal* point of the archetypal ray, a *slight* variation would carry it to the next higher ray, while the amount must be greater to carry it to a *lower* one. When a high division takes place it is usually near the next higher node. The high division of the brachial is usually as far up as the origin of the superior profunda.

Many examples of this law of convergence are seen in the lower vertebrates. In reviewing these it should be borne in mind that the original main branches of the aortic or spinal trunk are the hypogastric arteries, these being comparatively large vessels before the iliacs appear.

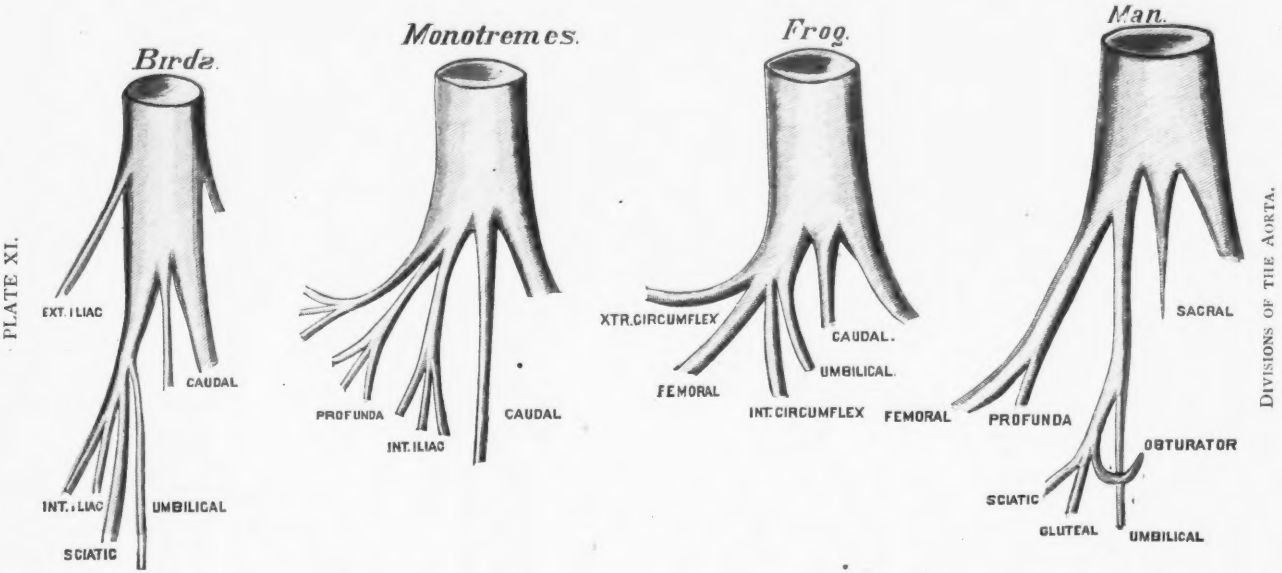
In birds we see the external and internal iliacs derived separately from the aorta — a case of defective convergence. In Ornithorhynchus the profunda femoris, the femoral proper and the internal iliac all come off together—another case of high division. A similar condition obtains in the frog, where two vessels, called the external and internal circumflex, whose homology is unknown to me, come off at the same point as the femoral and umbilical. (Plate XI.)

Another law creating diversity may be termed intersubstitution. A trunk may be diverted from its usual situation and found in the line usually occupied by a smaller vessel. This, it is supposable, may be from some cause affecting the fœtus, such as pressure, force of gravity, embolism, or those unexplained causes which we call atavism or reversion to an ancestral type. A similar phenomenon takes place after the ligation of vessels. The main trunk is reduced or disappears and the channel of collateral circulation becomes the main one.

Another striking example of this is the case where the femoral artery becomes posterior, passing down in the situation of the arteriole known as the comes nervi ischiadici. This is the normal arrangement in birds. (Plate XI.)

Functional activity of the parts to be supplied may undoubtedly considerably modify the size and arrangement of arteries.

PLATE XI.



DIVISIONS OF THE AORTA.

The variation of the long thoracic and uterine arteries in females when lactation and gestation are established, is a familiar example. In animals that move slowly or remain for some time under water, it seems to be sometimes necessary to provide for a slow purling of blood along nervous trunks. In sloths, the Ornithorhynchus and the manatee the main trunks break into plexiform arrangements, and in Cetacea large plexuses encircle the spinal cord. It is conceivable that the original capillary form has never been entirely overcome in these cases. So too in the alimentary canal of man. This, the oldest part of the body when viewed phylogenetically, has also the oldest form of circulation. The activity required is slow, but constant. Removed from external influences, it has not become as highly differentiated in function as the periphery of the body. The polypoid activity of the cells is best kept up by a gradual welling of the blood through a series of encircling capillaries. Even the larger branches show that they are incompletely differentiated. The branches of the mesenteric arteries do not each separately carry blood to the part they are to feed, but unite by cross anastomoses in a series of loops, the whole resembling an enormously enlarged capillary plexus.

If this view of arterial morphology be correct, all varieties found in man and animals should be reducible to the general case prefigured by the radiate fin of fishes. Any important series of exceptions that cannot be derived from the archetype would overthrow the theory.

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THE HAIRY WOODPECKER.

A. G. VAN AKEN.

THE pert, comely and invaluable bird designated in science as *Picus villosus* Linnæus, though known in general parlance simply as the hairy woodpecker, or "sap-sucker," has been variously portrayed by those attempting his biography. Careful inquiry among the masses discloses the fact that he is well and favorably known only to the few specialists in this department of natural history, while diversity of statement and contrariety of conclusion obtains as the rule.

In the present instance our purpose is merely to adduce some *bona fide* observations, gleaned during the past few seasons in New

Jersey, which may assist in determining, at least for the locality whence they were taken, the comparative abundance of the species as resident; the date of nidification; the number of eggs constituting a set, and the value of the bird under consideration to the pomologist.

We shall indicate certain facts brought to notice relative to our sturdy little friend, as we have seen and become intimate with him in his sylvan haunts in this State, while assuming domestic cares.

The compilation of facts from the library, or the examination of the skins of defunct specimens in some museum, we generously consign to those who attach more importance to this popular method than we are wont to accredit to it.

Ornithologists have assigned as the habitat of this species the Eastern section of the United States, though practically they differ as regards the abundance or even presence of the "hairy" in many sections of this district. We have found them moderately abundant here (New Jersey) in favorable localities, especially in the central portions of the State. The close resemblance existing between the hairy and the downy woodpecker (*Picus pubescens* Linnæus) in plumage, contour and habit has rendered the presence of the former often unnoted. The exercise of proper care, even by the beginner, will obviate such confounding of the cousins. The former averages 9–10 inches in length, the latter only 6–6½ inches, so that one may quite readily detect the "hairy" by his superior size. There are other well-defined distinctions, but that alluded to answers general purposes with little chance for error. Our experience during the past three seasons, making identification certain in each instance, has been the finding of almost or quite as many nests of the hairy as of the downy woodpecker, though some may be disposed to question such a statement. It is a fact, however, for which we vouch, and can easily adduce proofs therefor.

The date for nidification and the complement of eggs have caused us considerable trouble and annoyance. Thus writers are wont to state "four to five eggs are laid about May 1st–10th," crediting which we sought to arrange our plans for the securing of a set of eggs for the cabinet, in accordance therewith. But instead of being crowned with success, all our efforts were abortive. We were careful to secure date and number of eggs in reference to several nests that we found, certain of which were as follows: On

May 13th, 1880, we discovered our first authentic nest of the hairy woodpecker. It was situated in a partially dead swamp maple, nearly thirty feet from the ground. Though the day was warm, the shaft of the tree smooth, without limb or excrescence of any sort to assist us in shinning up to the coveted nest, we determined to secure the eggs if possible. We had nearly reached the entrance to the woodpecker's home, when, imagine our dismay, at seeing three young birds dart out of the hole and run nimbly up amid the topmost branches of the tree.

On or about April 20th, 1881, a friend detected a pair of these birds building a nest in a dead basswood, about twenty feet from the ground. Waiting about one week, he repaired to the tree and carefully sawed out a piece of the wood some ten inches below the hole and found the nest to contain three eggs. This he pondered was not a full set, so replacing the piece of wood and securely tying it, as he thought, with strong cords, he awaited the laying of one or two additional eggs. When we visited the tree again we were chagrined to find the cords cut by the sharp bills of the parent birds, the block, which had been sawn out, fallen to the ground and the eggs gone. Whether the old birds did not like the cords or were merely of an investigating turn of mind and wished to test the strength of the fastenings, or were actuated by a spirit of pure "cussedness" in destroying the nest and contents, we did not consider it worth while to inquire, but, deeming ourselves commiserable, decided that the very next time we were confronted with a set of three hairy woodpecker's eggs we would—wait for the appearance of one or two more? oh, no; rather secure the three despite the statements of the books that four to five composed a set, leaving to some other novice the verification of this statement.

Again, on April 28th, 1882, while passing through a tract of woodland, our attention was directed to a circular hole, deftly chiseled in a dead maple, whose top had been broken off by the wind. The hole was only a few inches below where the top had been carried away and about twenty to twenty-five feet from the ground. Our rap on the tree with a stick quickly brought one of the old birds to the entrance, when, perceiving us, very little time was lost in deserting this for an adjacent tree, where, in response to a few sharp notes, the mate delayed not to also take position and to unite in sounding a general alarm. After sawing out a piece

large enough to admit of an examination of the nest, we found only three eggs. We had almost forgotten the experience of the past season, so, instead of using cord to secure the piece which we had removed in position again, we nailed it in and departed, that the female might deposit the one or two eggs still wanting to make the number required by the statement of the books. Three days subsequent, viz., on May 1st, we again examined the nest by removing the nails and found that it contained, as before, three eggs; but there was this difference, now each egg was pecked and a young bird chirped at us from within the compliments of the day. This was an unlooked for as well as unappreciated greeting; so, closing up the aperture, we departed in disgust. We had in imagination already placed the set of glossy white eggs in our collection, in fact we had not counted our birds before they were hatched, but *our* eggs had hatched into birds, a possibility which we had not counted upon at all; an occurrence, by the way, not rarely met with by the procrastinating oölogist of limited experience. Two other nests, quite similarly situated, each contained young birds on May 8th and 10th, respectively.

It will be observed in the five instances above cited, the orthodox date and number of eggs in a set were not conformed to, a fact which we regretted very much, since we had pinned our faith upon the statements of eminent authorities in the matter. Perhaps these were very erratic specimens of this demure species which we chanced to encounter; we know not that this was the case, but this we do know, the facts stand as stated. Another season's experience similar to the foregoing will militate very strongly against the books as regard this section in the matter of the nidification of the hairy woodpecker. We shall assume in our personal operations the coming season that April 25th will do very well as the date to seek for the hairy's nest, and that three will make a set of eggs, though should we discover four or even five we will not reject them on that score.

A single word in reference to the value of the hairy woodpecker to every fruit-grower, despite a popular prejudice that strangely enough is still extant in many portions of our country, which finds expression in the persecution and extermination system adhered to by presumably educated men. True, the Count de Buffon painted in most sombre colors the entire family as "being condemned by *Nature* to incessant toil and slavery, dragging out an insipid exist-

ence, being a peculiarly wretched example of the inequality of the distribution of happiness," and many writers of more recent date, despite the eloquent refutation of the calumny by our greatest ornithologist, Alexander Wilson, seem to be imbued with a like spirit. But what is the true state of the case as vouched for in the testimony of every true working, field ornithologist?

A beneficent Providence has richly endowed the family of woodpeckers with qualities of rare excellence and worth. Especially is this true of the hairy. The principal count in the indictment against him, that he bores the bark of fruit and other trees in order to feed upon the sap and inner bark, will not stand, being utterly false. An extended examination of the contents of the stomach of this bird invariably fails to disclose an appreciable amount of either, but in their stead a huge mass of insects and larvæ. The perforations which he makes are merely for the purpose of securing his quarry from their ensconsure neath the bark out of the reach of other agencies. His is a work of destruction and death—the dislodgment and consuming of myriads of borers, &c.—not harm to the tree, but beneficial, as attested in innumerable instances. In this despised, persecuted bird, we have a true friend and effective co-worker, very materially assisting us in gathering an ample return of perfect fruit for the labor and care expended to this end in orchard, vineyard or garden. Ignorance and prejudice have no place amid the general intelligence and humane principles of to-day and should not be tolerated. Let no one, then, wantonly destroy either eggs or parent bird, but carefully foster and protect them, even using his influence to secure the punishment of all thus rendering themselves amenable to law and the just condemnation of every intelligent person.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— The Government of the United States is displaying a liberality towards scientific research which is worthy of high praise. The position assumed by our legislators on this subject is in accordance with the spirit of the age, and represents the intellectual status of the American people among the civilized nations. The appropriations made by Congress for the development and exposition of our resources have kept pace in amount with the increase

of our population, and the development of intelligence. Thanks to the character of the representatives of science at the seat of government, the expenditure of this money has been mostly wisely directed. A full share of support has been given to abstract science as distinguished from economic science. This is cause for congratulation, for in this utilitarian country, pure science is too often undervalued. It is remarkable, how, even in this day, the development of the mental instincts of our species may be neglected for the purely physical, as though human happiness did not depend as much on healthy mental as on bodily states. To state the case more precisely, human happiness depends as much or more on pleasant sensations (thoughts, etc.) of the brain, as on pleasant sensations of the skin and stomach. By purveying to the first-named organs our rulers receive the lively thanks of all people in whom the said organ has been developed into a large and active efficiency.

One of the most satisfactory features of our Government scientific work has been the liberality with which the books and atlases have been distributed. It is true that by this means some, perhaps, a good many copies, have fallen into unsuitable hands. But this is a slight offset to the great benefits done to scientific men of little means, to whom many of these publications are absolute necessities. We do not join in the cry of waste of Government money raised, because many of these works are temporarily sent in quantities to second-hand book-stores, etc., for ultimately they find their way into appreciative hands. We do not conceive that the recent change in the work of distribution is an advance on the old one. It is now the rule that a certain large class of scientific publications shall be sold at cost of production, and not be given away as heretofore. Apart from the hardship thus inflicted on the poorer scientific workers, as a simple question of right, the people are entitled to these works, since they are produced at the public expense and paid for by the peoples' money. What reason could have induced this change of policy we are at a loss to understand. It does not seem to be in the interest of science.

—— The latest accession to the antivivisectionists (*beastiarians* Owen) is Prince Bismarck. From his distinguished services in the past as a humanitarian, we anticipate for him great success as a beastiarian. Woerth, Gravelotte and Sedan all bear witness to the skill of his employés in humanitarianism; and as his facilities for "removing" people are still considerable, we expect to see the physiologists of Germany abolished; for surgeons only will be necessary under the reign of "humanity." Then the beastiarians who serve in the German army will be able the better in future wars to carry out the humane behests of the great Prime Minister.

RECENT LITERATURE.

LIEUT. SYMONDS' REPORT ON THE UPPER COLUMBIA RIVER.[1]—The object of this exploration is explained by the title given below; the results are perhaps the most important contribution to North American geographical science which has been made during the last two years, as it combines not only the results of the boat journey down the Upper Columbia, but also a good deal of information concerning the region drained by the headwaters of that river, obtained by Lieut. Symonds during explorations extending over a period of four years in the Upper Columbia valley. While the report is of much value to the Government, to the emigrant and to railroad men, as well as land surveyors, we will glance at some of the scientific results, premising that the geographer will find here the best and most compact account of the Columbia river, the romantic story of its discovery by the ship *Columbia*, from Boston, in 1792, and of the Cascades and the Dalles. In chapter IV, in citing the case of a log apparently stranded a thousand feet above the river, which he thinks could only have reached its present position "by being caught there when the river was a thousand feet higher than it is now," he goes on to say: "There are many other things which may be cited in proof that this river has but lately become reduced to its present size. All along up the river, wherever there is a concave portion of the bluff, there we find terraces of from ten to five hundred feet in elevation above their neighbor terraces below. These are all composed of rather loose soil, boulders and gravel, and river sediment, and have well-defined and sharp edges. These prove incontestibly the former grandeur of the river, and exist to a height of 2000 feet or more above the present river, and their sharp and well-defined edges would seem to prove their newness in the scale of time."

The Salmon river region needs explanation more, perhaps, than any other region; none of our exploring or geological surveys have ever penetrated into it; and only prospectors and scattered miners have ever explored it. In investigating the permanent region of the Rocky Mountain locust, we could obtain no information as to the nature of this large district. Lieut. Symonds calls attention to our almost entire ignorance of this region, and what he does say of the river must be new to our readers as it is to the reviewer. The Upper Snake river, as is well known, combines features of rare geological and scenic interest.

"From the vicinity of the Great Salt Lake the (Snake) river takes a north-westerly course, flowing through a tremendous cañon in which are numerous rapids and falls of great magnitude and

[1] *Report of an Examination of the Upper Columbia river and the Territory in its vicinity*, in September and October, 1881, to determine its navigability and adaptability to steamboat transportation. Made by direction of the commanding general of the Department of the Columbia. By Lieut. THOMAS W. SYMONDS, Corps of Engineers, U. S. A., Chief Engineer of the Department of the Columbia. Washington, 1882, pp. 133. Maps.

beauty, ranking with Niagara and the falls of the Zambesi, in Africa. The principal are the Great Shoshone falls, the American falls and Salmon falls. A number of streams flow into the Snake from the lands to the south and west of its course, principal among them being the Bruneau, Owyhee, Malheur, Burnt, Powder and Grand Ronde rivers. The main branches from the east are the Malade, Boisé, Payette, Salmon, Clearwater and Palouse rivers. Nearly all the streams flowing into the Snake may be characterized as mountain torrents flowing through deep cañons, entirely unnavigable and with very little valley lands along their courses.

"Some of them deserve more than a passing mention, especially the Salmon, the principal tributary of the Snake. It drains a large extent of country and joins the Snake about fifty miles above Lewiston, and flows through probably the deepest, grandest and most impassable cañon of any stream of corresponding magnitude in the world. Nowhere on earth can there be a scene more grand, gloomy and desolate than where these two rivers join their waters. Both come flowing down with torrential velocity through cañons 3000 feet in depth, with ragged, black and almost vertical sides, the milk-white waters of the Snake coursing alongside the clear blue Salmon water for a half mile or more before they finally mingle among the jagged rocks of the stupendous cañon below."

This and the following regions are now perhaps the least known of any part of the national domain, viz., the Olympic Mountain region; the region bounded on the north by the international boundary line, on the east by the Rocky mountains, on the south by the Columbia and Wenatchee rivers, on the west by Puget sound, and the regions of the St. Joseph and Clearwater rivers in Northern Idaho.

A chapter is devoted to the geological history of the Cascade mountains and the magnificent gorge of the Columbia through these mountains, based on the observations, in 1874, of Professor J. LeConte. The author has also ascended and measured the extinct volcanos in Southern Oregon, beginning with Mount Pitt, and including Mount Scott, Diamond Peak and the Three Sisters, the altitudes of which as given are all considerably below that of Mount Hood. He describes the surface geology of the Upper Columbia. The terraces he observed above the Dalles "go to show that previous to the Champlain epoch the cañon of the Columbia was cut to its present depth, and in some places far below it; that during the downward oscillation of the Champlain epoch this cañon was filled up by debris, boulders, &c., to a height of 2000 feet above the present river surface; and that at this time there was a great lake in the south-western part of the Great Plain of the Columbia." This Quaternary lake on the map is designated Lake Lewis. Many of the cañons in the Upper Columbia country were not valleys of erosion, but volcanic rents or fissures, and our author concludes that "the courses of many of the most

deeply encañoned rivers of this country were determined to a very great extent by their waters finding and collecting in great fissures, and that these fissures were formed during the late Tertiary or during the upward oscillation of the Glacial epoch."

PENHALLOW'S VEGETABLE HISTOLOGY.[1]—In this little book of about forty pages the author has brought together many things which the beginner in laboratory work ought to know, and has done so in such a simple and unpretentious style that it cannot fail to be of great use, especially to those who take up the study of vegetable histology by themselves, and who have no ready teacher or demonstrator always at hand. The book contains, first, a short chapter on reagents and media for examination. In this the more indispensable materials are briefly noticed, and remarks are made upon the methods of using them.

The second chapter deals with vegetable products. Here again only the more important are taken up. The physical characters are briefly given, and the various tests and the methods of making them are described.

Next we have in outline a course of study for a beginner, which is simply a classified list of subjects for study, beginning with protoplasm, the nucleus, chlorophyll, etc., and ending with the minute anatomy of the stem and leaf.

Three valuable tables are given, devoted respectively to cell-contents, cellulose forms, and plant products. These resemble the tables in use in chemical laboratories, and show at a glance the principal physical characters of most vegetable structures, and their reactions in the presence of different reagents. These tables will prove to be very handy for the beginner. A short list of books of reference is given, and finally eighteen or twenty pages of blank leaves are left for notes and memoranda.

In a prefatory note the author announces that "if there is sufficient encouragement, it is proposed to issue a second edition, in which the plan will be much extended, thus making it of greater advantage to the beginner, and also useful to the advanced student. With this end in view, suggestions from teachers and practical histologists will be gladly welcomed." It is to be hoped that in due time this promised enlarged edition may appear.—*C. E. B.*

LUYS' THE BRAIN AND ITS FUNCTIONS.[2]—This translation for the International Scientific series will prove useful to many readers. It contains statements of facts and principles of psychology with which every person should be familiar. The author, however, is not happy in all his attempts at generalization. A few leading ideas have to do duty many times under new names, and the skill dis-

[1] *Tables for the use of Students and Beginners in Vegetable Histology.* By D. P. PENHALLOW, B.S.; late professor of chemistry and botany in the Imperial College of Agriculture, Japan. Boston, S. E. Cassino, publisher, 1882.

[2] 8vo, pp. 327. D. Appleton & Co., New York, 1882.

played in doing this reminds us of the great feast served to the King of Spain, in which all the dishes were made of sows' ears. The translator has also not been entirely competent, for the language is sometimes involved, and un-English words are occasionally used. The book is, however, a valuable contribution to popular scientific literature.

JOURNAL OF THE POSTAL MICROSCOPICAL SOCIETY.[1]—This new magazine originated in the desire of the members of the Postal Microscopical Society of the United Kingdom to utilize notes and drawings that were buried in note books. Its two hundred pages of clear type, illustrated with numerous plates, contain jottings upon subjects too numerous to mention, yet the following illustrated articles may be cited as examples: Mr. Hammond on *Tubifex rivulorum*, "the most abundant worm in Thames mud;" the Rev. E. T. Stubbs on a supposed new species of Caligus, which the writer, however, does not name; Mr. Hammond on *Stylaria paludosa* on the larva of *Tanypus maculatus;* and on the structure and economy of Daphnia; E. Lovett's observations on the embryology of the Podophthalmata; and W. Horner's articles on the structure and habits of spiders. Although portions of the book exhibit the usual fault of microscopic work, viz., that much of it is work done for the sake of the microscope rather than to supplement the writer's observations and studies in some department of natural science, yet it contains much that is of value, especially to the zoölogist.

CROSS ON ANDERSITE FROM COLORADO.[2]—The rock in question is described by Dr. Whitman Cross as a compact, dark, almost black rock, containing a few macroscopic glassy feldspars and dark-green grains.

Microscopically it is made up of a ground mass composed of minute plagioclase crystals, pyroxene microlites and magnetite octahedrons cemented by a clear glass base, which sometimes contains light brownish globulites; all holding crystals of plagioclase, pyroxene, magnetite and apatite. The pyroxene is in small crystals and irregular grains.

Optical examination of the pyroxene crystals led Dr. Cross to regard them as belonging to two divisions, a pleachroic or orthorhombic one and a triclinic one. The former was looked upon as hypersthene and the latter as a triclinic representative of augite.

Chosen specimens of the rock were crushed, the powder treated with strong hydrofluoric acid until all the minerals except the pyroxene and magnite were dissolved; the latter was then withdrawn with a magnet. The pyroxene minerals were again treated

[1] *Journal of the Postal Microscopical Society*, a Miscellany of Natural and Microscopical Science. Edited by ALFRED ALLEN. Vol. I. London, W. P. Collins.

[2] *American Journal of Science*, New Haven, 1883 (3), XXV, 139.

with hydrofluoric acid until the triclinic pyroxene was almost entirely dissolved. The rhombic pyroxene was then analyzed and found to possess the composition of hypersthene. The isolation and chemical analysis of the rhombic pyroxene was performed by Mr. W. F. Hillebrand of the U. S. Geological Survey.

The conclusion drawn is, that a large proportion of the supposed augite is hypersthene in the andesites. The paper is an important contribution to the micro-mineralogy of andesite, and its publication in a completed form is awaited with interest. The following chemical analysis of the andesite was made by Hillebrand:

Sp. Gr.	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O
2.742	56.19	16.117	4.919	4.433	6.996	4.601	2.961
K_2O	MnO	P_2O_5	Cl	H_2O	Total.		
2.368	trace	0.266	0.022	1.028	99.901.		

—*M. E. W.*

Year Book of the German Malacological Society[1]—This excellent periodical has now concluded its ninth year of publication, a fact upon which malacologists may well congratulate themselves. Those only who have been personally engaged in upholding a periodical devoted to a speciality, addressed to a small audience of naturalists whose interest in their favorite study is too often counterbalanced by deficiencies of income,—they alone can realize what a successful nine years' struggle implies. The society whose organ it is, is partly an outgrowth from the Senckenbergian Museum of Frankfurt, its curators, students and friends. They began by publishing a "Nachrichtsblatt" which still flourishes in its fifteenth year, and which furnishes by its monthly or bimonthly numbers a convenient means for circulating conchological news, preliminary descriptions, obituary and business notices, proffers of exchanges, *et id omne genus*. The decay in interest and value of the much older "Malacozoölogische Blätter" originated by Dr. L. Pfeiffer, probably suggested a publication more worthy to be the organ of German Malacology. The last mentioned journal after an honorable and apparently successful career of many years, became, from causes unknown to us, irregular in its appearance (numbers being sometimes a year later in publication than their ostensible date), and degenerate in quality. It also contained little matter on any group except Pulmonates and few papers of serious importance. It continued to exist however, and recently has shown signs, under the editorial management of Clessin, of a new energy and greater usefulness. We trust that the time may not be far distant when it shall regain a position worthy of its long life and its distinguished founder. It is very possible that pecuniary troubles were at the bottom of the difficulties we have referred to.

[1] *Jahrbuch der Deutschen Malakozoologischen Gesellschaft, 1882.* Frankfurt am Main. Edited by Dr. W. Kobelt: M. Diesterweg.

Whatever the source of the plan of the Frankfurt journal, its inspiration and success are due more to its editor, Dr. Kobelt, than to all other co-operating causes whatsoever. His scientific qualifications for the task are well known, apart from which he possesses an artistic pencil of rare facility which has been employed freely for the illustration of the "Jahrbuch" from the beginning; while it is an open secret that to Madame Kobelt's brush we are indebted for the tinting of the beautifully colored plates which have graced the work from time to time. This lady is an enthusiastic collector and excellent conchologist, and her labors as well as those of her husband have been carried on in the midst of household duties and the busy life of a physician in a country village. These personal details may be pardoned, since devotion, under difficulties, to the promotion of science is the highest stimulus to those in similar circumstances.

It will be rightly inferred from the above that the journal has been well edited and illustrated from the first, and that it has contained in preceding volumes some of the best malacological papers of the time. The present volume is well up to the standard of its predecessors, and contains, beside notices of current literature and items of news, a continuation of Dr. Kobelt's useful catalogues of species, the most important of which in this volume are Fusus and Pisania; contributions to the conchology of South America by Dohrn and Dunker; of the Tyrol by Vincent Gredler; of China by Mollendorff; of Central Asia and Madagascar by Dohrn; E. von Martens contributes to our knowledge of the Pulmonates of Angola and Loango; P. Hesse discourses on the conchological aspects of Greece; Jickeli and Löbbecke describe various novelties; while Schepman contributes a thorough, well illustrated and important paper on the dentition of Hyalina. Herr T. A. Verkruzen, who is only too well known to American students from the Rafinesquean manner in which he has lately increased the molluscan fauna of our eastern coast, has two articles on the genus Buccinum, treated from his own standpoint. Kobelt more soberly gives us, apropos of part of the same material, data on the Buccinums of the St. Petersburg Museum, many of which are valuable as Middendorf's type, while in regard to others which served as texts for Verkruzen's observations we may be thankful to get any comprehensible information. We are informed that all of these will be figured for the monograph of Buccinum preparing for the new edition of the "Conchylien Cabinet" by Kobelt, when those who are interested in this subject will have opportunity of judging of the value of these criticisms.

By no means the least important of the articles in this volume is the editor's account of a conchological journey to Spain, under the auspices of the Museum, with a view of investigating various points in geographical distribution, but exigencies of space compel us to cut our remarks short, with the recommendation to con-

chologists and libraries to number the "Jahrbuch" among their possessions. One suggestion may be permitted: that the future numbers should contain an exact statement of the date of publication, which could be relied on in matters of priority, a matter of some importance in these days of rivalry in research.—*Wm. H. Dall.*

PROCEEDINGS OF THE MINERALOGICAL AND GEOLOGICAL SECTION OF THE ACADEMY OF NATURAL SCIENCES 1880–1881. No. 2.—This is a neatly printed little pamphlet of thirty-eight pages, containing the notes on subjects germane to the objects of the section, according to the title, during the years 1880–1881, and (to judge from Mr. Rand's last contribution on the volume C_6 of the 2d Geological Survey's publication, which did not appear till late in 1882), for this latter year also.

There are in reality but thirty-three pages devoted to science, the remaining five being filled with catalogues of members, names of authors, &c., and of these thirty-three, fourteen are of that short desultory character which make up what might be called a memorandum book of apparent facts which may one day be sifted of errors and usefully embodied into some systematic work. It is rather curious that with such a large array of amateur and professional workers in the line of these allied sciences, nineteen pages of octavo should cover the more or less completed work for three years.

There are thirty-six papers and short observations in all, of which fourteen are by Professor H. C. Lewis (secretary), and five by Mr. Theo. D. Rand (director), the latter including the only two moderately long papers in the pamphlet. These are, in reality, the only parts of the volume which can be reviewed, and it is proposed to devote a few words to them. The first of these papers is called, "Notes on the Geology of Radnor and vicinity," and is mainly a criticism of Mr. Chas. E. Hall's paper on the "Relations of the crystalline rocks in Eastern Pennsylvania" (Proc. Am. Phil. Soc., Jan. 2, 1880). Speaking of the serpentine, Mr. Rand says, that between the outcrops of the rock north-west of Radnor station and that near the Paoli, no outcrops of serpentine have been noted.

Mr. Rand doubtless refers to the description of serpentine areas in Rogers' final report, Vol. I, p. 168, when he skips from his second belt of this rock (south of the narrow limestone trough of the upper part of Gulf creek) to his third belt near the Paoli. Mr. Hall had no occasion to mention the occurrences outside of Delaware and Montgomery counties in C_6, nevertheless in the as yet unpublished but stereotyped C_4, he does describe the outcrops in Easttown township, Chester county. These outcrops could not possibly have escaped the *observation* of any geologist who has been in the township at all. Mining operations were conducted there anterior to the publication of Rogers' report, and it seems

more probable to suppose that mention of them was in some way omitted in the course of arranging his MSS for the press.[1] They are marked in Frazer's unissued map, which was colored in 1880.

Mr. Rand is right, in a sense, in insisting that the outcrops of serpentine should be represented by detached areas rather than by a continuous line, and Mr. Hall himself has been a notable champion for this kind of geological *Realism*, but it may be carried too far, and if this system had been uniformly adopted by all geologists, no continuous structure of large areas would ever have been attained. In the present instance it is almost as much a matter of judgment as of observation where the limits of the separate serpentine areas should be placed, for if the surface be minutely examined and its indications alone regarded, each of these areas will show numerous interruptions of a few feet or yards of continuity both *with* and *across* the strike, where the serpentinous matter is replaced by clastic rocks. In fact, much of the area called serpentine has little to ally it to that mineral but its blasting influence on vegetation, the rocks being of the most heterogeneous and nondescript character.

Mr. Rand complains that Mr. Hall makes no mention of the Potsdam sandstone which, following Rogers, he notes south of the South Valley hill, beyond the signalization of "sandy beds." We think that Mr. Hall is entirely right in this, for the reason that the hypothesis that these beds of white sand near the King of Prussia, for example, may easily have resulted from the decomposition of any of a great variety of rocks not Potsdam or any other sandstones. It is true that it would not be difficult to formulate a structure which would bring in the Potsdam sandstone at that point, whether the view that the rocks are Hudson river or that they are Huronian be accepted, since all agree that the Potsdam is represented in the same relative position on the other side of the river and not far off. To Mr. Hall there would be no greater difficulty in joining the Potsdam and the South Valley Hill rocks here, than in joining the Potsdam and the Chestnut Hill belt at the last named locality. On the other side of the question it would simply shift a little to the westward the intersection of the valley axis and the line of fault, which Frazer supposes to bring up the lower series to the present surface. The observation of the intersection of the Serpentine belt by the trap which has a more northerly trend in Easttown, is interesting but not new. The second paper, called "Note on the Geology of Lower Merion and vicinity," which is at the end of the pamphlet, is a criticism of Mr. Hall's volume C_6 of the 2d Geological Sur-

[1] In the copy of Rogers' final geological maps, before the writer, there appears to be a color indication of one of these detached Serpentine masses near the Spread Eagle tavern, in nearly a correct position, but of another exposure further west there is no indication. This, however, is not perfectly satisfactory evidence, as the colors on the final map fade differently in different copies, and the color for the serpentine especially is difficult to distinguish from accidental discoloration.

vey of Penna. series. The first view that Mr. Rand expresses is a "regret that the publication was not delayed until the adjacent parts of Delaware county were examined." This had been done before the issue of C_6, and we understand that the chief geologist is almost ready to issue C_5, which is to be devoted to Delaware county.

The criticisms as to location of the areas of serpentine, which Mr. Rand makes, are doubtless just, within the qualification previously made, as a large portion of these outcrops are but a short distance from his residence, and it is not likely that he can be deceived about a subject to which he has given so much attention. At the same time it must not be forgotten that what one observer would regard as evidence of a Serpentine outcrop, another would not. In this respect Serpentine outcrops occupy almost a unique position. It would seem to be only thus that such wide divergences as are here noted are explicable. Professor Lesley's remark that "the Serpentine belt of Bryn Mawr instead of passing in a straight line south-west * * * swings around southward in a curve towards Chester," &c., which evoked criticism three months ago from another source,[1] is here also demurred to, but as if it were a remark of Mr. Hall, whereas Mr. Hall nowhere appears to entertain such a view. The mistake which Mr. Rand appears to have made as to the true authorship of the remark, while quite natural, is a good illustration of one of the evils which result from too much editing and commenting by the superior officer of a geological survey.

The last two pages contain the real gist of the paper, and merit, together with the map accompanying, a more detailed study.

Mr. Rand regards what he terms the "Eurite," south of the Chester valley, "almost undoubtedly Potsdam sandstone," but the difficulty in the case is to account for outcrops of Potsdam sandstone of such widely different character existing so near together, across the strike, for forty miles and more. The North-Valley-hill, from Pomeroy to the Schuylkill, and beyond there, is composed of a white hard sandstone, making precipitous cliffs, poor vegetation and dazzling white hills. The same rocks turn the eastern end of the synclinal near Willow Grove, and come almost to the Schuylkill river as white sandstone. This point is marked by a line of trap which of itself is presumptive evidence of a fissure, and probably of a fault, and this line of trap continues far beyond the spot of which we are now talking; yet Mr. Rand would have us believe that the South-Valley-hill and the North-Valley-hill belong to the same formation. It is true that part of the difficulty is disposed of in assuming that to the Potsdam as to the Primal of Rogers belong under and overlying schists different from the sandstone proper; but this will remove only part

[1] The Horizon of the South-Valley-Hill Rocks, Frazer, Proc. A. P. S., Dec. 15, 1882.

of the difficulty, for a difference of horizon in the same formation at so short a distance would mean a fault, and if a fault is once supposed it is easier to imagine it several thousand feet in extent, if this will account for other phenomena such as the absence of the Potsdam where it ought to be on the northern edge of the southern belt of limestones; than a few hundred feet, leaving this and kindred difficulties to be disposed of by separate hypotheses.

That the syenite south of the South-Valley-hill is an anticlinal is very probable, since the whole structure of the South hill to the Octoraro creek is anticlinal; but that the "Eurite" which occurs north of the anticlinal and south of the South Valley hill represents the Potsdam, we think "almost without question" is not the case, for the reason among many others that the absence of the white sandstone between it and the valley would need accounting for.

The map which accompanies the paper is quite obscure, in spite of the explanations in the title, and it is difficult to ascertain whether the section given lies in Chester or Delaware county. One other feature of the paper is natural perhaps to communications intended for small bodies of scientific men, who become more familiar with each other's works than with those of the world outside. This may acount for an absolute silence as to the thinking and working of any soul on these very interesting and intricate questions except Professors Rogers and Lewis, Mr. Hall, whose work forms the target for this last contribution, and Mr. Rand who shoots.[1]—*P. F.*

RECENT BOOKS AND PAMPHLETS.—Truck Farming at the South, a guide to the raising of vegetables for Northern markets. By Dr. A. Oëmler. New York, Orange Judd & Co. From the publishers.

Final Causes. By Paul Janet, member of the Institute. Translated from the second edition of the French by W. Affleck, B.D. New York, Chas. Scribner's Sons.

Jamaica. Annual report of the Public Gardens and Plantations for the year ending Sept. 30, 1882. By D. Morris, M.A., director. Kingston, 1883. From the author.

The Storage of Electricity. By H. L. Greer. New York, 1883. From the author.

The Scientific Roll and Magazine of Systematized Notes. Climate. Vol I, Part II. Aqueous Vapor. London, 1883. From the Conductor, A. Ramsay, F.G.S.

Art Institute Lecture on Artistic Anatomy and the sciences useful to the Artist. By S. V. Clevenger, A.M., M.D. Chicago, 1883. From the author.

A study of the poison of the *Heloderma suspectum*, or Gila monster. By Drs. S. W. Mitchell and E. T. Reichert. Philadelphia Medical Times, March 10, 1883.

Sur un Saccodon d'espèce nouvelle provenant de l'Equateur. Par M. Al. Thominol. Ext. du Bulletin de la Societe Philomathique de Paris, 12 aout, 1882. From the author.

Ninth Annual Report of the Zoological Society of Cincinnati, 1882.

The Selective Absorption of Solar Energy. By S. P. Langley. Ext. from the Amer. Jour. of Science, March, 1883. From the author.

[1] Mr. Hall sends a reply to Mr. Rand's criticism, which will be printed shortly.

Beiträge zur Kentness der Flussfische Südamerika's, IV. Von Dr. Franz Steindachner. Wien, 1882. From the author.

On the value of the "Nearctic" as one of the primary zoological regions. Ext. Proc. Acad. Nat. Sci., Phila., 1882. By Professor A. Heilprin. From the author.

Observations on current American bibliography. By Dr. D. G. Brinton. Ext. from minutes Numismatic and Antiquarian Soc. of Phila., Apr. 5, 1883. From the author.

Allen's Human Anatomy, Section IV. Arteries, veins and lymphatics. By Harrison Allen, M.D. Philada., 1883. From the author.

Resúmen del Curso de Zoologia. Por A. Ernst. Caracas, 1882. From the author.

Memoirs of the Geological Survey. England and Wales. The Vertebrata of the Forest Bed series of Norfolk and Suffolk. By E. T. Newton, F.G.S. From the author.

Bird Remains from Mundesley. By E. T. Newton, F.G.S. Ext. from the Geological Magazine, March, 1883. From the author.

A review of the non-marine fossil Mollusca of North America. By Chas. A. White. Ext. from the Annual report of the U. S. Geological Survey. Washington, 1883. From the department.

Tertiary history of the Grand Cañon district, with Atlas. By Clarence E. Dutton. U. S. Geological Survey. Washington, 1882. From the department.

The International Scientists' Directory, in America, Europe Asia, Africa and Oceanica. Compiled by Saml. E. Cassino. Boston, Mass.

Annual report of the State Geologist for 1882. Geological Survey of New Jersey. Camden, 1882.

Elements of Orthoepy. Compiled for use as a text book in the Academy of Science and Art at Ringoes, N. J., by C. W. Larison, M.D., 1881. From the author.

Bulletin of the United States Fish Commission, Vol. I, 1881. Washington, 1882. From the commission.

The Eozoic and Lower Palæozoic in South Wales, and their comparison with their Appalachian analogues. By Dr. Persifor Frazer. From the author.

A contribution to our knowledge of the development of the Oyster (*Ostrea edulis* L.). By Dr. R. Horst, Utrecht. Translated by J. A. Ryder, 1882. Ext. Bulletin U. S. Fish Commission. From J. A. Ryder.

Concord Lectures on Philosophy. Comprising outlines of all the lectures at the Concord Summer School of Philosophy, 1882. Collected and arranged by R. L. Bridgman. Cambridge, Mass.

Memoirs of the Geological Survey of India. Palæontologica Indica. Series X. Indian Tertiary and Post-tertiary Vertebrata. Vol. II, Part V. Siwalik Selenodont Suina, etc. By R. Lydekker, B.A., F.Z.S. Calcutta, 1883. From the author.

Annual report of the Curator of the Museum of Comparative Zoölogy at Harvard College, 1881–1882. Cambridge, 1882. From Professor A. Agassiz.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ARCTIC ITEMS.—Reports of various kinds have been afloat respecting the whereabouts of the *Dijmphna*, but no authentic news has been received since that brought to Europe by Capt. Dallman of the *Louise*, and dated Sept. 22. Mistaking certain signals, she left the open lead in which she was, and which would probably have led her in safety to the Kara sea, and went to the

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

assistance of the *Louise*, then beset by the sea. She was caught in the pack and frozen in on Sept. 17. The wreck reported by the Samoieds proved to be that of an old Russian whaler. It has been decided by the Danish government to send out a search expedition.

The ice in the Spitzbergen and Barents seas has this year been so unfavorable for exploration that the geographical results have been almost *nil*. In 1881 the ice was exceptionally low down towards the coast of Norway, while there was open water north of Spitzbergen and Novaya Zemlya. In that year the ice disappeared with extraordinary rapidity when it once began to melt, while in 1882 it seems hardly to have given way at all. The north side of Spitzbergen has been almost inaccessible, which has not been the case for many years. Not improbably this was due to the northerly winds, which brought fresh ice as fast as the pack melted at its southern edge, so that possibly open water was present in the region around Bering strait. It is the opinion of Baron Nordenskiold and other authorities upon Arctic matters, that the Siberian seas can be navigated every summer from one end or the other, and that the past year was favorable to penetration by way of Bering strait.

Fresh attempts to open up a trade route between Siberia and Europe will this year be made by Mr. Sibiriakoff, Dr. Oscar Dickson and Baron Knop.

The members of the Lena Expedition are reported by Lieut. Harder to have been in excellent health and comfortably settled in winter quarters on Oct. 3.

An expedition, with Baron Nordenskiold at its head, will be sent out by Dr. Oscar Dickson, to explore the interior of Greenland. Baron Nordenskjold is confident that in the interior of this ice-covered land an oasis exists, and believes that he can reach it. It is hoped, also, to obtain some traces of the lost Norse colonies, last heard from at the end of the fourteenth century. Their very location is matter of dispute.

Cape Horn Expedition.—The members of the French Magnetic and Meteorological Expedition to Cape Horn took up their quarters at Orange bay, Tierra del Fuego, on Sept. 6, 1882, and commenced observations on the 26th. The air was very moist and rain plentiful. The mission was well received by the natives.

Asia.—Lieut.-Col. Beresford Lovett has published a map of the route from Teheran to Astrabad, and thence to Shahrud. The general aspect of Western Mazanderan is bare and arid, but is relieved by fertile spots, and Col. Elliott remarks that the villagers seem prosperous, wear good clothes, are fat and healthy-looking, and probably have a better lot than that of many Irish, German or Russian peasants. An opening of twenty feet wide in a dyke of basalt, which rises up eighty or ninety feet on each

side, is called the *Palang Durwaz* or Panther's Portal, and may be the famed Caspian gates about the position of which antiquarians are so uncertain. Damavaud, 19,950 feet in height, is an extinct volcano.

At Bostam, near Shahrud, is an ancient brick tower resembling the Kotul Minar at Delhi, but only some fifty or sixty feet high. It has a cornice of terra-cotta tiles with Kufic inscriptions.

Astrabad is in a fertile district, Shahrud, in a country where nothing will grow except by dint of digging, manuring and irrigating. Habits of industry have thus been developed at the latter place, the fruits and cereals of which are exported to Astrabad.

The north-east promontory of Borneo, though apparently connected with Sulu archipelago by a promontory and a series of shallows and banks, shows no traces of volcanic action; but is composed of sandstone and limestone, the latter often forming steep peaks. In the interior is a low plain of some 4000 square miles, having a heavy rainfall and numerous large rivers. One of these, the Kina Bataugan, winds so much that in 350 miles it is only eighty miles from the sea. It has been ascended by steamer for 150 miles. The banks of nearly all of these fine rivers are uninhabited, but it appears from the report of Mr. Pryer that much of it may prove suitable for settlers. The Sulu islands are very lovely, and are tolerably well populated by Sulus (Malays with an infusion of Arab and Chinese), Bajaws and other tribes. The interior of Sabah (the northern part of Borneo) is peopled only by tribes of Sundyaks' who are Dyaks with some admixture of Chinese.

Dr. Lansdell has returned from a journey of 11,000 miles or more in Western Siberia and Turkestan.

A native explorer has returned to India after a four years' absence in Tibet, and has finally proved that the basin of the Sanpo is separated from that of the Irawadi by a great range of hills. The traveler and his companions were robbed of most of their property between Lhassa and Lob Nor; and at Saithang (lat. 39°, long. 92°) one of his companions deserted after robbing him extensively. Taking service with Mongolians, he and his assistant pushed northward to Saitu (lat. 40°, long. 92°), probably the "Sachiu" of Marco Polo, and thence southward till they reached the Jesuit mission at Ta-tsien-lu. Thence they continued their travels, taking a circuit which nearly brought them back again to Lhassa, which they avoided to escape recognition, turning down to Chetang on the Sanpo, and thence via Giangze Long to Darjiling. As the instruments were not lost, a large number of observations for latitude were taken, and a more or less continuous traverse of his route was kept.

The narrative of the wanderings of Mr. E. O'Donovan in Northern Persia, of his venturesome excursion to the Merv oasis,

and his forced residence among the Tekke Turcomans, reads like a romance and is full of interesting facts respecting this "Queen of the World," which still contains 500,000 inhabitants. Here are the extensive ruins of Giaur Kala, the original site of Merv, destroyed by the Arabs about the end of the seventh century, and those of Bairam Ali, its successor, destroyed in 1784 by the Amir of Bokhara.

The travels of General Macgregor in Beloochistan (1876–1877) proved that the Mashkid and Mashkel rivers do not flow into the sea or into the Helmand, but after their confluence in the romantic pass of Tank Zorati flow mainly north-west to the Mashkel Hamun, a marsh with no outlet.

CAPELLO AND IVENS' TRAVELS IN CENTRAL AND WEST AFRICA.—The narrative of Messrs. Capello and Ivens, who left Benguela in Nov., 1877, in company with Major Serpa Pinto, and afterwards parted from him and explored the Cuango northward to about 5° S. lat., has been published.

The sources of the Cunene, Cuanza and Cuango were visited and determined, and considerable information obtained respecting the region. The country is mountainous, cut up by numerous streams, and in many parts rich in vegetation. The habits, dwellings, implements, weapons, etc., of these villagers are pretty much the same as those of other Bantü tribes which figure in the narratives of Pinto, Stanley, Cameron and others.

The Bihenos are the greatest native travelers in Africa, and Bihé is rich and fertile. Elaborate methods of dressing the hair prevail.

The sources of the Cuango were found at a height of 4756 feet, at about 11½° S. lat., and a little east of 19° E. long. Near this point arise an infinity of spring-heads, the sources of affluents of the Tchipaca, Cuango, Cassai, Lume and Loando, flowing towards the Congo-Zaire, Cuanza and Zambesi. The region around this remarkable watershed is rich in iron and copper, and produces a wealth of vegetable products.

The Cuango was followed to about 140 miles of the point where it discharges into the Congo, and was abandoned on account of the intense aridity of the country. The course of the river is obstructed by rocks, rapids and cataracts, so that it is unnavigable.

From the historical details given it is evident that for centuries the various African peoples have been in a state of constant migration.

GEOLOGY AND PALÆONTOLOGY.

NEW ORDERS OF CRINOIDEA.—In the second edition of his American Palæzoic fossils Mr. S. A. Miller characterizes three new orders and four new families of Crinoidea, with the following definitions:

Order Agelacrinoidea and family Agelacrinidæ. Body thin,

circular, parasitic; its lower side a thin, smooth membrane or plate of attachment; its upper side more or less convex, and composed of thin squamiform or imbricating plates, usually smallest at the periphery. Ambulacra, a double series of transverse alternating plates, with smaller ones sometimes intercalated. Two or more rows of ambulacral pores. The ovarian or anal aperature in one of the inter-ambulacral areas. The genera are Agelacrinus, Edrioaster and Hemicystites.

Order Lichenocrinoidea and family Lichenocrinidæ. Body attached during part or all of its life, circular, convex above, more or less crateriform around the stem. A thin, attaching plate on the lower side at some period of life. Upper side covered with polygonal plates, without traces of ambulacra, arms, mouth, pectinated rhombs or pores. Interior of visceral cavity with numerous radiating upright lamellæ supporting the polygonal lamellæ above. Stalk composed at its origin of interlocking plates, afterwards of circular ones, ending in a point, flexible and perforated longitudinally.

Order Myelodactyloidea. Body free, discoidal and possessed of an internal radiating system of pores, which increase by division, from the center to a tubular channel in the circular margin or surrounding cell.

This order contains the families Myelodactylidæ and Cyclocystoidæ, in the first of which the radiating and circular systems become complicated by the connection between succeeding coils through the flattened connecting finger-like processes; while in the latter the arrangement is more simple, as the interior radiations connect with a single marginal circular system.

Myelodactylus is a coil in one plane, the whorls connected by finger-like processes, and each whorl is composed of a series of plates, having a tubular channel within.

Cyclostoides has a circular marginal series of plates, with a tubular channel, connected with the interior by numerous pores that radiate from the center. In both these genera, the only known types of their families, the structure is so different from that usual in the Crinoidea, that the terms calyx, ambulacra, arms, etc., cannot be applied.

Cyclostoides is from the Hudson River group, Myelodactylus from the Niagara, and Lichenocrinus from the Hudson River and Utica slate.

The Geology of Southern Africa.—The following is a somewhat condensed quotation of the lately published narrative of Messrs. Capello and Ivens:

"The physical configuration of Africa, south of the Equator, may be thus summed up: A depressed central basin, surrounded by a vast circle of high land, gradually descending to the sea, and rent by deep ravines, through which rush huge water courses, engendered in the interior, till they overflow and seek the lower level

fronting the ocean. From a very general geological point of view we may define the regions running from the littoral to the interior in the following order, viz., limestone, sandstone and granite. These distinctions are not very exact on a closer view, the component parts run into each other and change places, while precise lines of demarcation are wanting. The west coast at the points observed by us between Loanda and Mossamedes, and even further to the north, shows a belt of tertiary deposits near the sea, with abundant masses of sulphate of lime and sandstone, from which they are separated by beds of white chalk alternating with primary rocks, mostly gneiss, abounding in quartz, mica, hornblende, granite and granulated porphyry. Towards the south large tracts of feldspar are visible. At Mossamedes whole mountains are composed of sulphate of lime, while carbonate of lime (in shells) is frequent. Rock-salt and nitrate of potash occur stratified. We were told that a basaltic line of great length exists along the Moscambe chain. From that point commence true *saharas* of shifting soil, abundant in sand, as in the parallel of Tiger bay. In the transition from the lower zone to the interior, as at Dondo, the soil of vast tracts is composed of schist, in perfect laminæ, and sandstone, red with oxide of iron, is visible in every direction. In the mountains further in the interior the ground is composed of granite-quartzy rock, extremely hard and compact; this is the case throughout the belt up to Pungo N'Dongo, the surface soil being formed by disintegrated granite.

These geological characters will naturally be repeated north and south in identical parallel regions, with variations in the high table-land, where we meet occasionally with hard and tough red sandstone and rocks of feldspar, as in the basin of the Lucalla."

REMARKABLE LAND-SLIPS.—A late number of *Knowledge* contains a remarkable account of two land-slips. The first of these occurred near Fort de l'Ecluse, at Mt. Credo, on the Rhone. The *Times'* Geneva correspondent says: "The condition of things is serious. The entire side of Mont Credo, on which the forts are built, appears to be giving way, and more earth-slips are feared. The lower fort is considered past saving, and the garrison has been withdrawn. The rocks on which the fort stand are said to be undermined. If they should fall into the Rhone, which is exceedingly narrow thereabouts, the course of the river will be completely blocked, and the entire valley, for over twenty miles, joined to the lake. This is another evidence, on the large scale, of the great levelling action which is going on continually all over the world, the ever-active tendency on the part of mountain masses to get to a low level, having plenty to work upon in Switzerland."

A correspondent of the *Dublin Express* writes as follows respecting a "Moving Bog." The incessant rain produced immense floods in the neighborhood of Castlerea. A bog moved a considerable distance, causing serious losses to the adjoining farms.

About midway between Castlerea and Bellinagare—a distance of six miles—there is a gently sloping vale abounding in rich meadow and pasture lands. The road is somewhat higher than the fields. Along this valley the bog forced its way. On reaching the road it was held in check for a time, but eventually bursting across and rushing with amazing rapidity, it covered in its course over 120 acres of fine "pasture" lands. All communication between Castlerea and Bellinagare (by this route) is cut off, huge masses of bog coating lie on the road ten feet deep. The bog commenced a half mile from the road. The bog has showed signs of moving for many years back. The cause is attributed to defective drainage. It started suddenly, reaching the road over half a mile distant in ten minutes. The fields are now covered with twenty-six feet of bog. It has now forced its way into the river Suck, which flows through this town.

INTERMITTENT WELLS IN NEBRASKA.—In looking over the April NATURALIST I was glad to see the facts concerning these wells so authoritatively stated. A few years ago, while examining the geology of that region, I learned something concerning them, but did not have time to investigate them as I wished. I now have no doubt of the facts and little concerning their explanation.

The region is table land slightly sloping toward the south-east, away from the Platte river, which flows along its northern margin. Its geological structure is quite uniformly, as follows:

Surface soil	2–3 feet.
A yellowish clayey soil (typical loess)	30–40 "
Ancient soil	2–5 "
A reddish, coarser loess-like clay	40–45 "
Sand, with some gravel	40–60 "

The underlying rock is unknown, but probably belongs to the Niobrara group. It is not unlikely that Bowlder clay underlies the sand considerably, for it is well developed a little east of David city, and judging from the depth of wells I infer that its surface slopes gradually toward the west, nearly to Shelby, if not beyond.

The belief of the farmers of the region, "that the water-level in these wells corresponds to the level of the Platte river, I do not hesitate to say, is correct. I was once quite skeptical about it, but careful examination of scores of cases in Polk, York, Adams and Kearney counties have fully convinced me of the existence of a vast subterranean lake, as it were, in this great sand deposit. The surface of this lake must not be conceived as a true level, because its southern side is drained by the numerous streams which head in these counties and flow southward, the Platte descends rapidly eastward, but such variations are not very apparent. In a *very* few cases permanent water is found in wells above this level, where we may suppose a local basin-shaped deposit of clay.

This subterranean circulation of water was first announced by

Professor S. Aughey, of Lincoln, and more particularly of the region further west, between the Platte and Republican (*vide* Physical Geography and Geology of Nebraska, p. 59, also U. S. Geological Report for 1874).

As to the cause of the rise and fall of the water in the wells of the region, we may conclude that it is primarily due to a varying pressure of the atmosphere. This may be inferred from its observed connection with the direction of the winds. Southerly winds usually attend a low barometer and winds from the north bring high barometer. Hence we interpret the observations under consideration, as showing that the water in the wells rises when the barometer falls, and *vice versa.*

A circumstantial cause, so to speak, is the *extensive sand deposit* in which the water is found, and which by rising above the water becomes a great reservoir of confined air for the more compact deposits overlying its present free circulation in that direction.

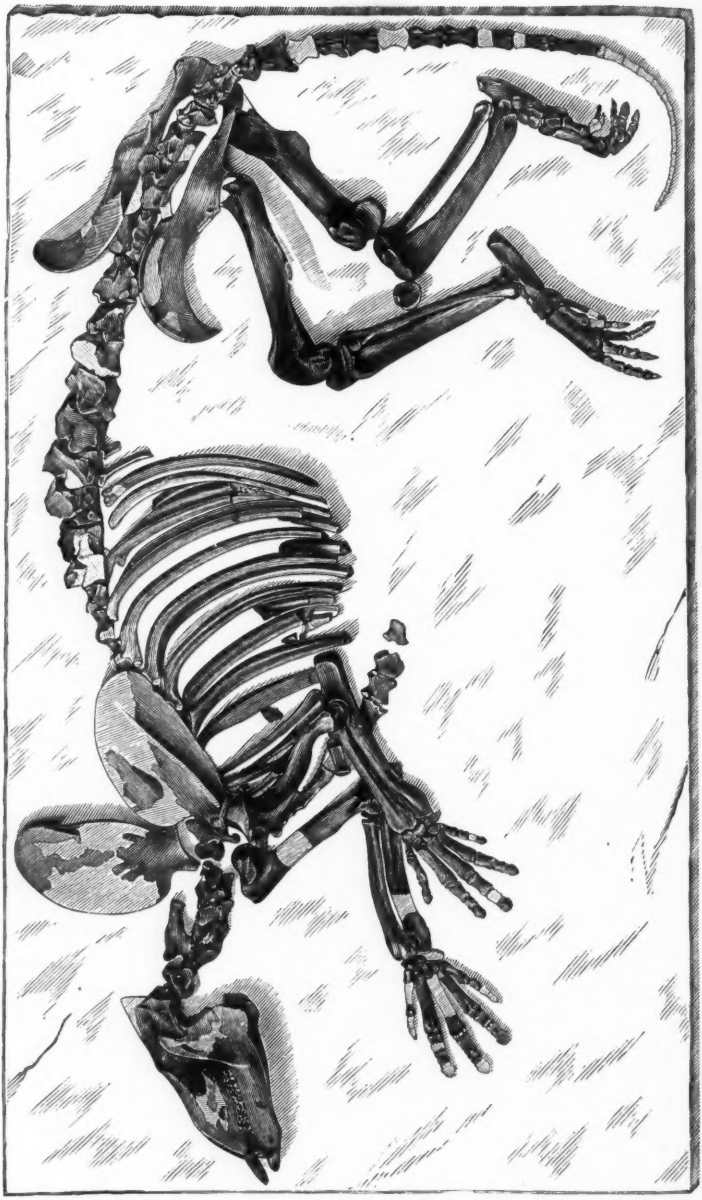
If the barometer is steady for a few days, we may suppose this reservoir is charged with air of uniform density and exerting uniform pressure over the whole surface of the water, which is therefore free to take a level outline. Let the barometer fall rapidly and immediately there is less pressure upon the surface of the water in the well, while elsewhere it remains nearly the same. Hence the water is sucked up, as it were. The opposite would follow from the rising of the barometer. Moreover, a current of air would pass in or out the mouth of any well, with velocity varying according to the suddenness and amount of the change of barometer, and the extent of the reservoir for which that well serves as a vent. The phenomena reported are likely, therefore, to become less marked as the country settles up and the number of wells increases.

Numerous cases are detailed in *Nature* (Feb. 15th, '83,) where air issues from wells which have been sunk in sandstone or other porous rocks, also from delf-pits and cesspools. In some cases these have been made to blow whistles so as to indicate by sound the changes of the barometer. In a few cases reported, disturbances in the water of the wells were noted either of ebullition or variations of level. Mr. Strahan, who writes the article, seems to think it necessary to assume the existence of "fissures" or "caverns" in the adjacent sandstone to explain the movements of the water. Such may be true of the cases he considers, but cannot be of the Nebraska wells, unless the interstices of unconsolidated sand and gravel can be so designated.

Nearly three years ago I had a very instructive conversation with a Mr. Mackie, probably one of the gentlemen certifying to the facts under consideration, in which he kindly gave me many items observed by him in his extensive experience in that region as well-digger. Some of them, with others of my own observation, are the basis of my generalization above.—*J. E. Todd.*

Library of
Miami University.

PLATE XII.



PHENACODUS PRIMÆVUS COPE, ONE-SEVENTH NATURAL SIZE.

THE GENUS PHENACODUS.—This genus has been referred to in this journal at various times (see especially 1882, p. 522), as an important one in the phylogeny of the Ungulata. I give now a figure of the best preserved specimen of the genus, with the bones in place, as they were found by Mr. Wortman. The species is the *P. primævus* Cope. The specimen as it laid in the sandstone of the Wasatch formation, was divided by a gutter which scattered the posterior dorsal and lumbar vertebræ. These were all found, with one exception, and arranged in place. The head was also found separate a few inches distant. There are probably nine species of Phenacodus known. The largest of these is the *P. nuniënus;* next is the *P. primævus.* and then follow in order of size, *P. puercensis, P. vortmani, P. macropternus, P. brachypternus, P. calceolatus, P. zuniensis.* The last two and the *P. puercensis* are from the Puerco epoch, the others are from the Wasatch.

The measurements show that the *P. primævus* was as large as a Big-Horn; that its body was rather longer than in that animal, and its legs shorter and more robust. It was, in fact, proportioned more as in the common American tapir, but was of smaller size. The middle three toes of both feet reached the ground, while the first and fifth projected laterally and posteriorly, like the dew-claws of the hogs. The tail was longer and heavier than that of any of the living hoofed animals, resembling in its proportions that of the wolf. The eyes were small and the muzzle long, but was singularly soft above. Whether this soft part was pierced by valvular nostrils, as in the hippopotamus, or was produced into a short proboscis, as in the saiga or in the tapir, cannot be certainly ascertained, but there are indications of the insertion of important cartilages, if not muscles, on the superior faces of the premaxillary bones.

The animal was probably omnivorous in its diet. It was not furnished with any weapons of offense or defense pertaining to the osseous system, so that it must have sought refuge in flight. The well-developed muscular insertions of its limbs and the digitigrade character of its step, indicate that it may have had considerable speed.

The bones of this species have been found wherever the beds of the Wasatch epoch occur, but most abundantly in Northern Wyoming. From the Wind River valley Mr. Wortman brought two specimens, and ten from the Big-Horn basin. One of the latter is now figured.

In a future number of the NATURALIST I hope to give a similar figure of the *P. vortmani,* of which a nearly equally complete specimen has been found.—*E. D Cope.*

GEOLOGICAL NOTES.—*General.*—The Marquis of Saporta, in a quarto, entitled "Apropos des Algues Fossiles," replies to Nathorst's criticisms as to the manufacture of vegetable forms from tracks of invertebrates, by acknowledging the latter's facts, while

he rebuts the inferences, showing that though some markings may be questionable, others are undoubtedly impressions of plants.——Professor Owen spoke upon generic characters in the order Sauropterygia, before the London Geological Society, December 20, 1882. Pliosaurus approaches nearer than Plesiosaurus to a generalized Saurian type, as the teeth have the pair of strong enamel ridges upon the opposite sides which occur also in the Crocodilia, and the large size of the head and shortness of the neck show an approach to the fresh-water Saurians. Polyptychodon exhibits a third modification of the type. Professor Owen omitted to notice the important work of Seeley on this group.

Silurian.—Dr. Lindström has published a treatise upon the Upper Silurian fossils of the north-eastern part of Sz-tshwan (China). These chiefly belong to well-known Silurian genera, but include Gomphophora, a coral with completely perforate walls and six short spinous septa in each corallite; Ceriaster, which resembles Columnaria, but has interior dissepiments and increases by intracalicular budding; and Platyphyllum, allied to Calceola in the form of the cup, and to Goniophyllum in interior structure.——Professor Winchell, in the tenth annual report of the Geological and Natural History Survey of Minnesota, refers the Keweenaw cupriferous red sandstones, shales and conglomerates; the light-colored horizontal sandstones of the south shore of Lake Superior in Wisconsin (with fucoids and Scolithus), and the St. Croix sandstone with its Lingulæ and trilobites, to the Lower Silurian.

Devonian.—In the *American Journal of Science* for February, Dr. H. S. Williams writes of a remarkable molluscan fauna at the base of the Chemung group, presenting much resemblance to that of the Kinderhook group. The facts point to a Kinderhook fauna, the center of which was mid-continental, and a typical Chemung fauna which had its center in the Appalachians. These blend at Ithaca, N. Y.——In the same journal J. M. Clarke describes three species of Dipterocaris, a fossil genus of crustacea from the Portage and Transition shales, and the lowest beds of the Chemung.

Cretaceous.—In a late number of the *American Journal of Science*, Mr. C. A. White gives some observations upon the molluscan fauna of the Laramie group. This fauna stands out distinct from that of any other geological formation, and to a large extent consists of brackish forms.

Tertiary.—Where was the geological editor of *Nature* when M. Garman's letter on the destruction of American Miocene mammals by "blizzards" came to hand? It is generally supposed that skeletons must be covered by sediment in order to become fossilized, which is not the case with animals overwhelmed by snow. And Mr. Garman's blizzard-killed cattle, where will their

bones be next year? Not fossilized certainly. Fossil bones may be split by frost, but if the frost attacks them before they are fossilized, their chances of being preserved are small indeed!

Quaternary.—The remains of *Colymbus septentrionatis* Linn, have been discovered by E. T. Newton, in the Mundesley River bed, Norfolk, England.——The arguments respecting the Loess are still continued. Dr. A. Nehring, of Berlin, answers H. H. Howorth, in the February number of the *Geologicol Magazine.* He gives a list of the steppe animals found in the European Loess (Lagomys, Dipus, Spermophilus, Arctomys, Cricetus, Hystrix, Arvicola, Equus, Antilope), and asserts his belief that a considerable part of Germany or Central Europe once had a steppe fauna and flora. This fauna was interposed between the Arctic fauna of the glacial period, and the forest fauna of the Neolithic epoch. Postulating a fauna and flora like that of East Russia and West Siberia, Dr. Nehring maintains that the wind may have played an important part in the formation of the loess-like deposits of many places in Central Europe.——H. H. Howorth concludes his "Traces of a great Post-glacial flood" in the March number of the same magazine. The marine drift, in which littoral and deep-sea shells are often found confusedly heaped together, in some cases with little mixture of sand or shingle, and confined to small areas, unaccompanied by those sheets of silt which must have remained had subsidence been the cause of its formation, yields, in Mr. Howorth's belief, conclusive evidence of a great wave of waters, carrying the shells to varying heights and distances according to the conformation of the coast.

MINERALOGY.[1]

THE NOMENCLATURE OF METEORITES.—As a result of a careful study and classification of the 306 meteorites in the collection of the Museum of Natural History at Paris, Professors Daubrée and Meunier have introduced a large number of new names, which, however useful for classification, cannot be said to be a welcome addition to the already large nomenclature of lithology. The generic names, based on the amount of iron in the meteorites, appear to be well chosen, but the specific names are taken from the locality where the specimen chosen as a type happened to fall, and being without scientific import, will not receive general acceptance. By the valuable work of the authors, our knowledge of the origin and characters of meteorites has been greatly extended, but it can hardly be expected that lithologists will adopt all the names in the following classified list:

METEORITE.

I. HOLOSIDERITE.

Octibbehite, tazewellite, nelsonite, catarinite, braunite, caillite, schwetzite, jewellite, campbellite, burlingtonite, tuczonite, lenartite.

[1] Edited by Professor H. CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

II. SYSSIDERITE.

Pallasite, atacamaite, brahinite, deesite, lodranite.

III. SPORASIDERITE.

1. *Polysiderite.*—Toulite, logronite.
2. *Oligosiderite.* — Aumalite, chantonnite, aiglite, montrejite, parnallite, luceite, canellite, mesminite, belajite, butsurite, manbhoomite, banjite, limerickite, menite, bustite, richmondite, tieschite, erxlebenite, quincite, stawropolite, tadjerite, rutlamite, renazzite.
3. *Cryptosiderite.*—Howardite, omansite, chladnite.

IV. ASIDERITE.

Igastite, rodite, eukrite, shalkite, chassignite, bokkevelite, orgueillite.

The classification adopted by Tschermak is much more simple, being as follows:

I. METEORIC STONES.

1. *Eukrite.*—Anorthite and augite, iron being rare.
2. Olivine, bronzite, enstatite; iron rarely seen.
3. *Chondrite.*—Olivine and bronzite with iron.

II. METEORIC IRON.

4. *Mesosiderite.*—Silicates and meteoric iron forming a granular mixture.
5. *Pallasite.*—Meteoric iron porphyritically enclosing crystals of silicates.
6. Meteoric iron.

GELATINOUS SILICA.—Dr. H. Leffmann has found that at the bottom of bottles containing certain siliceous geyser waters from the Yellowstone National park, there is deposited a quantity of gelatinous matter looking like the white of egg, which, on analysis, proved to be nearly pure silica. It was entirely structureless, and by heat dried to a white opaque mass. After having been inclosed for several weeks in a closed vessel with strong sulphuric acid, it shrank to about one-tenth its volume.

The water from the "Opal spring" is opalescent, appearing like what is produced by adding an alcoholic solution of rosin to a large volume of water. The opalescence remains for months, gelatinous silica not being deposited unless the water is evaporated.

ZEOLITES FROM FRITZ ISLAND.—B. Sadtler, Jr., has analyzed the chabazite, mesolite and apophyllite from Fritz island, near Reading, Pa. The analyses are published in the *American Chemical Journal*, and they agree closely with analyses of the same minerals from other localities.

NATIVE LEAD FROM IDAHO.—Professor W. P. Blake has found native lead and minium near Bellevue, Idaho, where they occur in galena. The native lead, a rare species, "is in small rounded masses or grains from an eighth to one-quarter of an inch in diameter, and sometimes in irregularly reniform bunches, weighing an ounce or more. The red oxide is in the form of coatings or crusts on the metal."—*Amer. Jour. Science.*

TOPAZ FROM MAINE.—Mr. G. F. Kunz has discovered topaz in fine and large crystals at Stoneham, Maine. Some of the large opaque masses were parts of crystals measuring a foot across. Of transparent crystals one of a bluish and greenish tint measured 2½ inches vertically and three inches across. A number of interesting minerals are associated with the topaz.

TURQUOISE FROM ARIZONA.—Professor W. P. Blake, in an interesting article in the *American Journal of Science* for March, describes some ancient mines of green turquoise in Cochise county, Arizona. The turquoise, which he has called "*chalchuite*," from the aboriginal name of the gem, is of a light apple-green color like that from New Mexico, and has a specific gravity of 2.7–2.8. It occurs in rock in seams and veinlets rarely more than an eighth or a quarter of an inch in thickness.

The locality is interesting from an archæological point of view. The mine had been worked probably by the Aztecs and Montezumas, and many ancient stone implements were found about the mine. Turquoise was in general use among the various tribes of Mexico, and was worked with considerable skill by ancient lapidaries.

Professor Blake thinks that turquoise should receive the mineralogical name of either "*callainite*," a modification of Pliny's name "callaina," or "*chalchuite*," derived from "chalchihuitl," a name probably older than Pliny's.

MOLYBDENITE IN HONG KONG.—F. Warrington Eastlake, in a communication to *Nature*, notes the occurrence of molybdenite or molybdenum glance (MoS_2) on the island of Hong Kong. Silver has been observed in small quantities, also galena, lead and iron pyrites.

The composition of the molybdenite is, sulphur 40 per cent, molybdenum 60 per cent, or one per cent less of sulphur than is given by Dana as the composition of American molybdenite.

WATER IN CHALCEDONY.—A geode of chalcedony recently received from Salto river Uruguay, contains an unusual amount of water, between two and three drams being observed. These geodes occur in a basaltic formation of amygdaloid and melaphyr.

SOME ENCLOSURES IN MUSCOVITE.—Professor Lewis, in a paper read before the Philadelphia Academy, on Dec. 26, 1882, discusses the enclosures of biotite and magnetite so frequent in the muscovite of Southern Pennsylvania and Northern Delaware. By dissecting a crystal of muscovite enclosing biotite into a consecutive series of cleavage laminæ, a vertical section of the crystal is obtained, which, as exhibited in an accompanying plate, shows that while the edges of both the outer and inner crystals remain parallel in successive plates, the substance of the black biotite is gradually eaten away, and is replaced by the encroaching musco-

vite as the summit of the biotite crystal is approached. The inner black crystal contains a small hole filled by white muscovite, and this hole enlarges with successive plates until finally the biotite has completely disappeared, as though eaten away by the muscovite.

The author confirms the observations of Reusch and Rose on the parallelism of the crystallographic planes of the micas, as proved by their "strike-figures." The biotite is often altered into an exfoliating *hydro-biotite*, just as muscovite changes into margarodite (*hydro-muscovite*).

The superficial markings of reticulated magnetite are also discussed, and shown to be always parallel in direction with the lines of the artificial "strike-figures." Their direction is, therefore, not due to any twinning crystallization of the dendrites themselves, but to the governing influence of the crystallographic lines of the muscovite.

DOPPLERITE.—W. Demel has analyzed a homogeneous specimen of dopplerite from Aussee, and after drying at 100°–120°, finds 56.42–56.51 per cent. of carbon, and 5.34–5.20 hydrogen, leading to the formula, $C_{12}H_{14}O_6$. The ash contained a large percentage of calcium, the greater parts of which had probably been combined with the organic matter. Experiments were made to show that dopplerite could combine with calcium, and the conclusion is reached that this mineral may be regarded as the calcium salt of one or several acids belonging to the humus group.

"MOTHER OF PETRE."—The very interesting discovery, announced a few years since, that saltpetre (nitre) is formed in nature by the action of a living ferment, just as alcohol is formed by the growth of the yeast fungus, introduces new conceptions of the origin of the nitrates, and shows that the process of nitrification, like that of acetification, is a true growth. As shown by F. H. Storer, in a recent number of *Science*, the practical application of this fact was made use of as long ago as 1686, when Sewall speaks of the necessity of getting "seed petre or mother of petre" to make a successful saltpetre bed. When these "saltpetre yards" were worked in Europe in order to obtain the nitrate for the manufacture of gunpowder, and it was desired to start a new yard, it was said to be necessary to insure success to bring some earth from an old yard and mix it with the new earth.

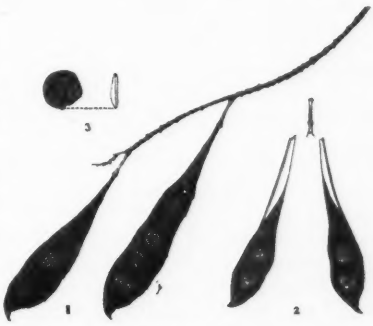
The organism which acts as the nitrifying ferment has been shown by Schlösing and Müntz to consist of very minute round or slightly elongated corpuscles, existing either singly or joined in couples; being of slow growth, and multiplying by budding. Dr. A. Springer, in the last number of the Proceedings of the Ohio Mechanics' Institute, describes some experiments of his own, in which the nitrates in an infusion of certain roots of plants were dissociated and nitric oxide evolved through the action of a fer-

ment composed of small cylindrical rods which moved rapidly across the field of the microscope with a wriggling motion, often bending themselves to form a circle. This may be the same as that mentioned by Bechamp under the name of *Microzyma cretæ*. In the same journal, Professor R. B. Warder gives a list of papers referring to the influence of bacteria upon the changes of nitrogenous compounds.

That the natural nitrates are the result of a fungoid growth is a fact interesting to mineralogists as well as to chemists, biologists and naturalists generally.

BOTANY.[1]

Dispersion of Seed by Wistaria.—In January of the present year I gathered a few pods of the Chinese Wistaria (*Wistaria consequana* Benth.), and placed them in a vase on the mantel shelf. A few evenings after, while sitting at a table in the center of the room, with my back towards the mantel, I was startled by a loud, snapping report, and the consciousness that something struck against the ceiling directly above my head, and then against a window shade at the extreme end of the room. I imagined that this circumstance was caused by the explosion of an unusually refractory piece of coal in the stove, which was burning at the chimney behind me, with the door wide open. But I soon discovered that the smallest of my Wistaria pods, Fig. 1, had ruptured, and that the flying missile was one of its enclosed beans, which I found on the floor a few feet from the window, where it had rebounded after striking the shade. Fig. 3 represents this bean with its spiral lines of dark shading, and also gives a transverse section. All the figures are drawn one-third of the natural size. The valves of the pod in question, as shown at Fig. 2, turned entirely inside out at their lower extremity, and separated from their pedicel, not at the well marked juncture, but at a little distance below it. The other pod of the same raceme was wrapped in paper and laid away. A few days after I happened to hear the noise occasioned by its rupture, and found it had separated from its pedicel in the same manner, that is, about half an inch below the joint. This



Wistaria Pods.

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

Wistaria bean, above mentioned, was thrown violently for a distance of sixteen feet and rebounded four feet. If it had been ejected with the same force from the position in which it grew on its native vine, it certainly would have flown for a distance of at least thirty feet. At all events, its enclosing pod proved itself to be an energetic vegetable catapult.—*Rev. J. L. Zabriskie, Nyack, N. Y., March, 1883.*

ADDENDUM TO ARTICLE ON THE COMPASS PLANT (*Silphium laciniatum*).—In the NATURALIST for August, 1882, to the list of papers on the subject, at the end should be added:

THOMAS HILL, LL.D.—Proceedings of Am. Ass. for Adv. of Science at Troy, August, 1870, p. 285.

THOMAS MEEHAN—Proceedings of Acad. of Natural Sciences Phila. for 1870, pp. 117–118.

——do. for 1875, p. 270

——Flowers and Ferns of the U. S., with colored plate of the plant, 2d series, 1880.

The extract on page 634 from paper by Francis Darwin in Journal of the Linnean Society, Vol. XVIII, No. 112, 1881, has some errors and omissions. It was copied from another journal. Now that I can copy from the original I give in full his conclusion of experiments "On the power possessed by leaves of placing themselves at right angles to the direction of incident light." He says, p. 449: "Thus the result of the experiments with the klinostat is on the whole to confirm the view published in the 'Movements of Plants' [by Charles Darwin, pp. 438–444], that the power which leaves have of placing themselves at right angles to the incident light, is due to a specialized sensitiveness to light, which is able to regulate or govern the action of other external forces, such as gravitation, or of internal forces such as epinasty."

He defines, p. 421, the terms epinasty and hyponasty, employed by De Vries and himself, as follows: "An organ is said to be epinastic when the longitudinal growth of the upper half or upper face exceeds the growth in length of the lower half; epinasty, if unopposed will therefore result in the organ becoming convex above and curving downwards.—Hyponasty is the reverse of epinasty, that is to say, the organ curves upwards owing to the lower increasing more than the upper half in length."—*Benjamin Alvord, Washington, D. C.*

AN APICAL CELL IN GYMNOSPERMS.—One by one the old characters relied upon to distinguish the cryptogams from the phanerogams are disappearing. We have long supposed that in the development of the stems and roots of phanerogams we had one character which could be considered reliable. The growing point (*punctum vegetationis*) in the cryptogams is a single cell, which by repeated fission gives rise to the mass of cells making

up the stem or root. On the other hand, in the flowering plants, it has always been held that the growing point was made up invariably of a *group* of cells. We had thus a marked difference which seemed to draw a sharp line between the flowering and flowerless plants. It is true that in the ringless ferns (Marattiaceæ) of the tropics, and the adder tongues (Ophioglossaceæ), the growing point in the root is a group of cells, thus making a slight exception to the law, but in all these plants the stems develop from a single apical cell. So well established did this difference appear that in our "Botany for High Schools and Colleges," this sentence occurs (p. 87): "In the phanerogams the primary meristem is developed from a group of cells, instead of from a single one; they therefore have no apical cell."

We have now, however, the announcement by Dingler, in a recent paper (Ueber d. Scheitelwachstum des Gymnosperm-Stammes), that by making careful sections of the stems of seedling gymnosperms and rendering them transparent by maceration in water or by the use of potash, he was able to make out the presence of an apical cell in quite a number of instances. Thus an apical cell was well made out in a species of Ceratozamia, one of the Cycadeæ. It was also seen in the Norway spruce (*Picea excelsa*), in *Pinus inops* and *Cupressus pyramidalis*. In a single instance an apical cell was detected in a species of Ephedra, but as other observations failed to verify this, its occurrence may be doubted.

The importance of these observations will be obvious to every student of comparative botany (if we may be permitted to use such an Agassizian term as the counterpart of "comparative zoölogy"). They indicate a still closer relationship than we have suspected between the vascular cryptogams and the gymnosperms. It is significant that this pteridophytic character is to be found only in the *young* plants, in accordance with the biological law that disappearing structures may persist in the embryo or early life long after they have ceased to occur in the adult.—*C. E. Bessey.*

Transition between Forms of Schizomycetes.—C. v. Nägeli (Unters. u. neidere Pilze. München, 1882) is of opinion that all known forms of Schizomycetes are connected by intermediate links, and that any division into species, however convenient for the purpose of description, has no scientific value. There is no doubt that the same species occurs in widely different forms dependent on the mode in which it obtains its nourishment.—*Jour. Royal Mic. Soc., Feb., 1883.*

A Government Duty.—The Government has long recognized the duty of providing means for the careful and exhaustive study of those insects which are injurious to the crops of the farmer, gardener, tree grower, etc. It has appointed eminent scientific men to devote their strength and time to the investigation of in-

sect pests, and has placed sufficient sums of money at their disposal to enable them to visit different parts of the country, and thus to give to their work a thoroughness it could not otherwise have had. This is as it should be, and no intelligent person now doubts the usefulness of the Entomological Department at Washington.

But if the investigation of injurious insects be considered a government duty, will not the same reasoning show it to be equally its duty to provide for the similar investigation of the numerous parasitic fungi which injure and often entirely destroy farm and garden crops? The damage annually wrought by the fungi is but little if any less than that by insects. Take, for example, but one of the many affecting wheat and oat crops, viz., the rust, and we find that through it alone the country loses every year many millions of dollars; how many millions we hardly dare venture even to surmise, lest we be accused of exaggeration. However, as the annual wheat crop of the State of Iowa, is about forty millions of bushels, a reduction of but one tenth on account of the rust, would amount to a loss of four million dollars. When we remember that it is a very common occurrence for the injury from this cause alone to be fully a quarter or a third, and sometimes even one-half, it is evident that the annual loss must be placed considerably higher rather than lower. Add now the annual losses suffered on account of the smuts of various species, which affect wheat, oats, barley and Indian corn, and we have for the United States a sum aggregating at the very lowest estimate allowable, from fifty to one hundred millions of dollars.

But the losses are not confined to our staple cereal crops. The destroying fungi, like the harmful insects, are found attacking all our growing plants, whether upon the farm, in the vegetable or flower garden, or the conservatory. Even after our crops are gathered they are subject to the attacks of molds and mildews which unfit them for food and hasten their decay. And the very timber of which our houses and barns are constructed is infested by species which cause decay and destruction. It is needless to specify further. We have in the parasitic fungi and in some of the saprophytic ones, a host of enemies which annually destroy immense values. Is it not one of the duties of the Department of Agriculture at Washington to undertake the thorough and exhaustive study of these enemies? In what way could the department do more good to the great agricultural interests of the country than by inaugurating such a work?—*C. E. Bessey.*

Botanical Notes.—In the March *Grevillea* M. C. Cooke describes and figures a new Gasteromycete (*Cycloderma ohiensis*) from Ohio. In the same journal the editor describes and figures a curious case of a Vaucheria with distinctly septate filaments. All doubts as to its identity were removed by finding the characteristic oögonia and antheridia. He strongly suspects that under

certain conditions zoögonidia may be produced by vaucheria, and suggests the need of careful re-examination of all the species. ——Wm. Trelease has published an interesting paper "On the Structures which favor Cross-fertilization in Several Plants" (Proc. Bost. Soc. Nat. Hist.), in which many curious facts are brought together. Three plates accompany the paper, and add much to its value.——Professor Grant Allen's paper on "The Pedigree of Wheat," republished in the *Popular Science Monthly*, for March, from *Macmillan's Magazine*, is an entertaining though rather speculative account of a possible genesis of the grasses in general, and the wheat plant in particular. The main proposition is given in the opening sentence, "Wheat ranks by origin as a degenerate and degraded lily."——A flowering plant, new to science, from North Wales, has just been described by Arthur Bennett in the *Journal of Botany*. It is a Potamogeton, and is named *P. griffithii*. As long as new species can be found in Great Britain our collectors need not despair in any part of the United States.——J. G. Baker's "Synopsis of the Genus Selaginella," now running through the numbers of the *Journal of Botany* will form, when completed, a valuable addition to our knowledge of these beautiful and interesting plants. We hope to present a summary of it when completed.——Some curious monstrosities in fungi are described and figured in the October and January numbers of *Revue Mycologique*.——We have received a set of Pacific Coast Ferns from J. G. Lemmon, of Oakland, Col., the well-known collector. Among them are many very rare and interesting species. The specimens are generous, well preserved and neatly labelled. ——The same collector is preparing for distribution sets of phanerogams, including many new species, or rare ones, from the Arizona region. Among these are *Astragalus hypoxylus* Wats., *Mimosa lemmoni* Gr., *Stevia plummeræ* Gr., *S. amabilis* Lemmon, *Erigeron lemmoni* Gr., *Gentiana microcalyx* Lemmon, *Ipomœa thurberi* Gr., *I. lemmoni* Gr., *I. cuneifolia* Gr., *Verbena arizonica* Gr., *Euphorbia plummeræ* Wats., *Microstylis purpurea* Wats., etc.—— Ravenel's Centuries VII and VIII of Fungi Americani, have been received. They contain many interesting species described or noticed in recent numbers of *Grevillea*.

ENTOMOLOGY.[1]

RAILROAD CARS AS A MEANS OF DISSEMINATING MOTHS.—Have you ever thought of the railroads as a means of disseminating Noctuidæ? Traveling more than usual the past fall and summer, I was often struck with the numbers of Aletiæ on the trains. There were probably many others on the outside fluttering at the lights or at rest upon the cars. I do not give it as of great value or by any means conclusive; but there has

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., may be sent.

been this season a sort of coincidence between lines of railroad and abundance of cotton worms. The northern limit of these last, so far as I could learn, in central Mississippi, was just south of Holly Springs, in Marshall county, within a breadth of some fifteen miles, five east of the railroad and eight or ten west thereof. On the Mobile and Ohio road, in the eastern part of the State, the northern limit of the worms was Baldwyn, with a western spread of eighteen or twenty miles. Between Baldwyn and Booneville, the next station to the north, is an almost desert stretch of twelve miles of low, swampy land, nearly destitute of cotton, and but one night train runs northward. On the Mississippi Central, on the contrary, there were some three regular north-bound trains at night.

Another coincidence is worthy of mention. In 1881 I could hear of Aletiæ, north of Tallahatchie, only at two points, both in this (Marshall) county. The first extended from the river northward four miles, and but a short distance east and west of the railroad. The second was four miles south of Holly Springs, on the eastern side of the track. In 1880 there were two points of propagation of Aletia north of Tallahatchie; one near Waterford, the first station, four miles north, and the other, at Holly Springs, fourteen miles north of the river. The latter was in the nearest cotton to the station, and nearly a mile east of it, the town lying to the west.—*Judge Lawrence Johnson, Holly Springs, Miss.*

Insects as Food for Man.—Mr. Max Buchner's Contributions to the Ethnography of the Bantus[1] contains the following interesting notes which show that insects are by no means despised as food by this tribe of negroes, which inhabit a large portion of Southeastern Africa.

Toward the end of the rainy season, in April, when the white ants are swarming, the conical buildings of these insects are covered with a dense matting of banana leaves, while within this cover, vessels are placed with funnel-shaped entrance. In these vessels a vast number of white ants, males and females, are caught and roasted on the spot. They are considered a great delicacy, even Mr. Buchner finding them very palatable.

A large, fat, subterranean cricket, as well as a large Coleopterous larva, living in hollow trees, are equally sought for and roasted over fire.

But it is especially a large caterpillar called "ugoungoo," which is harvested by the natives like a field crop. It is about five centimeters long, black, with yellow rings, occurs on the savannas, and "belongs perhaps to the butterfly Crenis." Whenever it appears in large numbers the negroes march out in full force from their villages, camping out for weeks in the wilderness to gather and cure the crop. After the intestines have been pressed out, the

[1] *Das Ausland*, January 8, 1883, p. 23, ff.

caterpillars are dried before the fire and rolled up in packages of fresh leaves. To a civilized taste they are most disgusting, the smell reminding one of that of our cabbage worms.

In view of this custom it seems to be strange that the Bantas refuse to eat snakes and amphibia of all sorts, even frogs and lizards not being touched by them in times of starvation.

NUMBER OF MOLTS AND LENGTH OF LARVAL LIFE AS INFLUENCED BY FOOD.—Those who have had extensive experience in rearing insects, come to appreciate the variability inherent in most species whether in characters or in habit. Hence they feel as little sympathy for those who discuss a question of habit as though this last must needs be forever fixed in some one observed direction, as for those who indulge in the hair-splitting of species on trivial grounds.

In 1876 we hatched from the egg, larvæ of both *Tenebrio molitor* and *Tenebrio obscurus*, with a view of ascertaining the number of larval molts. Experience had taught us that they are cannibalistic, so that each larva experimented with was isolated. Eggs of *molitor*, laid May 29th, hatched a few days afterwards (June 5th). One larva molted for the first time June 15th, and by May 3d of the following year (1877) had molted eleven times when it died. A second larva, hatched on the same day (June 5th), had molted twelve times by June 10th of the following year (1877), when it died. Of *obscurus*, three larvæ, which hatched April 30th, 1876, were reared to the imago state. One molted but eleven times by August 30th of the same year, became a pupa January 20th, 1877, and finally a beetle, February 7th, 1877. The other two both molted twelve times and attained the imago state February 18th and March 9th respectively. All were, as nearly as possible, under like conditions of food and surroundings, and in all cases the molt that gave the pupa is not considered among the larval molts.

Since March 13, 1879, we have kept two larvæ of that common museum pest (*Trogoderma tarsale*) in a tight tin box with an old silkworm cocoon. They were half grown when placed in the box. On November 8, 1880, there were in the box twenty-eight larva skins, all very much of a size, the larvæ having apparently grown but little. The skins were removed and the box closed again as tightly as possible. Recently, or after a lapse of two years, the box was again opened and we found one of the larvæ dead and shriveled up; but the other was living and apparently not changed in appearance. There were fifteen larva skins in the box. We cannot tell when the one larva died, but it is certain that within a little more than three and a-half years two larvæ shed not less than forty-three skins, and that one larva did not, during that time, appreciably increase in size.

We know of no observations which indicate the normal or average length of life, or number of molts in either Tenebrio or Tro-

goderma, but it is safe to assume from what is known, in these respects, of allied species, that in both the instances here referred to, but particularly in the case of Trogoderma, development was retarded by insufficient nutrition and that the frequent molting and slow growth resulted therefrom and were correlated.—*C. V. Riley.*

OVIPOSITING OF DIPLAX RUBICUNDULA.[1]—During the first week of October I had an excellent opportunity of watching the egg-laying of this handsome little dragon-fly. They were quite abundant in a small artificial pond, whose banks were of rock, extending about two feet above the surface of the water. A little before noon they appear flying over the water coupled in the peculiar manner so well known in the dragon flies. As soon as fertilization has been accomplished, and while still held together, the female begins to deposit the eggs. The pair hover close to the surface of the water, and within a few inches of the bank. In this position the female dips the extremity of her abdomen slightly into the water; then both flying forward, the abdominal end of the female is curved strongly forward so as to strike the vertical surface of the bank just at the same time as the head of the male strikes it. These movements of wetting the tip of the abdomen and depositing the eggs alternate with great rapidity. Sometimes the water is not fairly reached the first time trying; in which case the dipping is repeated. Similarly the egg-laying movements are sometimes repeated; apparently, because the first movement was not successful.

The eggs are so glutinous that they adhere very easily. The number layed with each movement varies. Sometimes there is but one; more frequently there are more. At first they are pearly white, but after a few hours they become a shining brown. The vertical wall of rock was found to be very thickly covered with them.—*Professor W. A. Buckhout, State College, Pa.*

A SMALL BELOSTOMA CAPTURES A FISH.—In examining a small stream in Dakota last August, to see whether it was passable for my buggy, I pushed aside the weeds growing at the edge of the water and saw a strange sight. A Belostoma about three-fourths of an inch long seemed to have just vanquished a fish three or four times its own length, and like a dace in form. The bug, when first seen, was on the fish near the tail. The fish, struggling feebly, turned over on its side and the bug crawled forward to its throat and apparently pierced it with its bill, and both disappeared in a thicket of fallen weeds lying in the water, whether by the slight struggles of the fish or the strength of the bug, I cannot say. All this occupied but little time, and being several

[1] Compare also the process as observed in *Perithemis domitia* and a species of Diplax in "Embryological Studies on Diplax, Perithemis," etc. By A. S. Packard, Jr. Memoirs Peabody Academy of Science, Salem, 1871.—*Ed.*

feet away, I could not see minute points distinctly. It is probable that the main struggle occurred before I disturbed them.—*J. E. Todd, Tabor, Iowa.*

MOSQUITOS VS. MALARIA.—Dr. A. F. A. King, dean of the Medical Faculty of Columbian University, recently read a paper before the Philosophical Society of Washington, D. C., in which he endeavored to sustain the thesis that malarial disease is produced through the instrumentality of mosquitos, which, by their punctures inoculate the body with the malarial poison.

While we cannot agree with Dr. King in his conclusions, it is interesting to note how ingeniously prevailing phenomena connected with malaria may be made to apply to the well-known habits of the mosquito. Dr. King presented a series of twenty statements drawn from the best medical authorities in relation to malaria and which he argued would equally apply to mosquitos. They are briefly as follows:

1. Malaria prevails most in moist and low localities.
2. It is rarely developed at a temperature below 60° F.
3. It is checked by a freezing temperature.
4. It is most virulent towards the equator and along the sea-coast.
5. It has an affinity for dense foliage.
6. Forests and woody tracts act, nevertheless, as an obstruction to its spread.
7. Atmospheric currents transport it.
8. It is developed in previously healthy places by digging up the soil or making excavations which are apt to be followed by stagnant pools.
9. Bodies of water in the line of winds that waft it, have the power of arresting it.
10. Absence of mosquitos appear to prevent malarial diseases.
11. Malaria diminishes in proportion as a country becomes more thickly settled.
12. It usually keeps near the surface of the earth.
13. It is most dangerous after sunset.
14. Persons are most exposed to it while sleeping.
15. The white race is the most sensitive to it.
16. Fire destroys it.
17. It diminishes towards the center of cities.
18. It is most prevalent in late summer and autumn.
19. It is arrested by walls, fences, hills, rows of houses, curtains or even gauze-veils or mosquito nets.
20. It spares infants more frequently than adults.

ENTOMOLOGICAL NOTES.—Mr. R. M. Lachlan having recently written on the occurrence of a marine caddis-fly in New Zealand belonging to the genus Philanisus, Dr. Hagen calls attention to the fact that in the report on the condition of the sea-fisheries of the south

coast of New England (1873, pt. 1, p. 379) he mentions a Phryganid larva, probably a Molanna, found in Menemsha bay, Mass., in connection with *Chironomus oceanicus* Pack.——The report of the Director of the (Illinois) State Laboratory of Natural History has just been received from Professor S. A. Forbes and exhibits a comprehensive plan of work, covering general natural history. The investigations into the food of fishes and of birds, and into the nature of parasitic plants and animals that are being prosecuted in this laboratory, are of the most satisfactory and thorough character, and give the laboratory preëminence in these fields. In the entomological work Professor Forbes has been ably assisted by Mr. F. M. Webster and Mr. W. H. Garman.——In his first annual report of the Ohio Agricultural Experiment Station, Director Wm. R. Lazenby makes a satisfactory showing and devotes considerable space to economic entomology. In almost every case the experience at the station with remedies for the more destructive insects accords with and corroborates that which we have placed on record.——In the Proceedings of the Ameriman Philosophical Society (vol. xx, June to December, 1882), recently issued, there are two important entomological papers. The one is Dr. S. W. Williston's "Contributions to a Monograph of the North American Syrphidæ." As the genera and species of this family occurring in the United States have never before been tabulated, this careful paper is indispensable to the student of our Diptera. The second paper is the "Revision of the Dermestidæ of the U. S.," by Dr. H. F. Jayne, accompanied by four plates, drawn and engraved by Dr. G. H. Horn. As Dr. LeConte's synopsis of that family, written nearly thirty years ago, has become incomplete by virtue of subsequent discoveries, Dr. Jayne's paper is a most welcome contribution.——Mr. Franklin Hill contributes in the *American Journal of Science* (xxv, p. 137–138) a short illustrated paper on the antenna of Meloe, referring to the well-known distortion of that organ in the male sex and explaining its use during copulation.

ZOÖLOGY.

Sudden Destruction of Marine Animals.—Professor T. Rupert Jones accounts for the manner in which a large number of marine animals have in past ages suddenly perished in their own element and been entombed: 1. (fishes) By either unusual or periodical influx of fresh water from the land; 2. By volcanic agency; 3. By earthquake waves; 4. By storms; 5. (fishes) By suffocation, when massed together in frightened shoals, or when burrowing in sand and mud and accidentally buried by other sands and mud; 6. (fishes) By being driven ashore by fishes of prey; 7. (fishes and mollusks) By too much and too little heat in shallow water; 8. (fishes and mollusks) By frost; 9. (fishes) Diseases and parasites; 10. (fishes and mollusks) Miscellaneous causes: dis-

turbance of equilibrium of living and dead organisms, ferruginous springs, poisons, lightning, &c.; 11. Marine life surviving in fresh-water lakes.—*Journal of the Royal Microscopical Society.*

Desiccation of Rotifers.—The Rev. Lord S. G. Osborne, referring to a previous letter of Mr. Jabez Hogg as to the Rotifers and Amœbœ revived from "earth" taken from Durwaston, says[1] that it was simply the dust of the garden which happened to deposit itself in certain cup-like receptacles, made artificially of a substance which coated itself with an oxide, giving to the dust when wet a rusty appearance. After having been in a drawer for more than three years no symptom could be detected of a decrease in the number or activity of the stock. He adds: "It is to me inexplicable that although I have collected very many specimens of the Rotifer (*R. vulgaris*) from plants taken from ponds, I never could acclimatize these in my tanks so that they would bear the drying process so successfully as when procured after my own fashion."—*Journal of the Royal Microscopical Society.*

The Cause of "Rot" in Sheep.—The transformation of the parasite worm, or liver-fluke, which causes "rot" in sheep, after many years of effort on the part of different naturalists, have, at length been discovered, nearly simultaneously, in England and Germany. Mr. A. P. Thomas writes to *Nature* that the winter of 1879–1880 was marked by a widely-spread outbreak of the liver-rot among sheep. The losses during that winter were estimated at three million sheep, of about one-tenth of the total number in Great Britain, and during the next winter the losses were equally severe. It had for years been known that the cause of the disease was the occurrence in the liver of large numbers of the liver-fluke (*Fasciola hepatica*), and that these parasites invaded sheep, or sometimes other animals, allowed to feed in wet pastures and especially on flooded ground; but, notwithstanding that the subject had been repeatedly investigated by numerous zoölogists, including Professor Leuckart, of Leipzig, so well known for his researches on animal parasites, the manner in which the disease was incurred remained a complete mystery, It was known, indeed, that the animals most nearly allied to the liver-fluke, the digenetic Trematodes, presented an alternation of generations and that they possessed larval forms infesting various species of mollusks. These nurse-forms, as they are called, produce internally larvæ, usually tailed, known as Cercariæ, which leave the nurse and encyst themselves in some other mollusk or in aquatic insect larvæ, etc., and remain there quiescent, only reaching maturity if swallowed, together with the animal harboring them, by some suitable vertebrate host. Such is a typical instance of the development of a Trematode with alternation of generations; but there is a good deal of variety in the life histories of the different species. It was

[1] *Times*, 4th October, 1882.

supposed that the liver-fluke had a somewhat similar life history; but all attempts to discover what mollusk served as intermediate host had been fruitless.

The Royal Agricultural Society of England having offered a grant for the investigation of the natural history of this destructive parasite, Mr. Thomas undertook the research, and in April, 1881, after working through the summer and autumn of 1880, he suggested that a snail (*Limnæus truncatulus*) was really the intermediary host. For over a clearly circumscribed area of infection, situated on the side of a hill far above the reach of floods he found that almost the only species of water-snail occurring in the ground was *Limnæus truncatulus*, found in a boggy spot. This contained an interesting form of Cercaria, produced in a cylindrical *redia* or nurse-form provided with a digestive tract.

The Cercaria had a tail, which, when fully extended, was more than twice the length of the body. It was exceedingly active, but soon came to rest, showing a strong tendency to encyst itself in surrounding objects. Mr. Thomas had a few months previously seen a sheep, which he had the best possible reason for knowing to be infected with flukes, wandering over the boggy spot from which the snail containing the Cercaria came, and the presence of so highly-developed an organ for the production of the substance of the cyst in a Cercaria which encysted on any plants at hand, seemed to indicate that here was the Cercaria of the liver-fluke, and it has since proved that such was the case. Moreover, he had collected evidence from independent sources, which rendered it probable that the parasite was taken up by the sheep while grazing from the damp roots of grass, most likely in the encysted condition. During the summer of 1881 no snails were to be found, and last winter the sheep near Oxford were free from the liver-rot. In 1882, however, there were floods on the Isis in July, and *Limnæus truncatulus* was brought down by the water in vast quantities, probably from marshy ground far up the river. On discovering these snails, he started infection experiments with them, and was at once successful. The adult fluke in the liver of the sheep or other mammalian host produces vast quantities of eggs. So prolific is it that he has estimated the number produced by each fluke to be, at least, several hundred thousand. The eggs pass with the bile into the intestines, and are distributed over the fields, with the manure. If the eggs fall on wet ground or are washed into a ditch, development continues, and after a time, the length of which depends upon the temperature, embryos are hatched out of the eggs.

For the purpose of his infection experiments Mr. Thomas obtained eggs from the livers of affected sheep, and kept them in water until the embryos were hatched, and then transferred them to vessels containing the snails to be experimented upon. After the embryos enter the snail, they best develop in the pul-

monary chamber, as well as in the body cavity. Here the embryo undergoes a metamorphosis, becoming elliptical in shape. It becomes a mere blood-sac, in which the next generation is produced. The germs increase in size and each becomes a *redia*, as the nurse-form, provided with pharynx and intestine, is called. When the *redia* is ready to come forth, it breaks through the walls of the brood-sac (sporocyst), increases in size, finally becoming one-twentieth of an inch in length. Within them develop from minute cells germs of which form Cercariæ, each with a sucker at the anterior end and another in the middle beneath. They have, also, the anterior part of the body covered with exceedingly minute spines, and this form is believed by Thomas to become the fluke-worm. Similar forms in the same species of snails were at about the same time reared independently by Professor Leuckart, in Germany, whose statements confirm those of Mr. Thomas in the *Zoölogischer Anzeiger*. Mr. Thomas' final paper appears in the *Quarterly Journal of Microscopical Science* for January, and is illustrated with several plates.

CHROMATOPHORES IN CRUSTACEANS.—Dr. Max Weber has described the structure of *Haplophthalmus* and *Trichoniscus*, genera belonging to the exceptional Isopod sub-family of Trichoniscidæ. The structure of Trichoniscus, save in regard to externals, had not before been investigated. The copious details which such an essay contains must necessarily be studied in the original. Points of general interest, affecting other isopods, are duly indicated.

Dr. Weber makes a digression on the subject of chromatophores. Leydig first showed that in the same situations as chromatophores are found cells without pigment, but otherwise similar, the whole forming one common system. Also animals of constant tint possess non-contractile cells, presumably homologous with chromatophores. These are unquestionably distributed to the chromatophores. By means of gold chloride Dr. Weber has proved this connection in the case of a common isopod (a young Philoscia). Anger, fear, love and other emotions undoubtedly cause animals with chromatophores to change color; yet it is usually assumed that the play of the chromatophores serves to hide their possessor, and perhaps in some cases for protection. But Leydig saw tree-frogs amid their natural surroundings, change spontaneously their beautiful green for a dirty gray tint, just as they are known to do in captivity, especially during murky weather. The inference follows that a depressed temperature here acts on the chromatophores, particularly when we consider that these organs are an appanage of pœcilothermous animals. We learn from v. Platen, Moleschott and Tubini, that light acting directly on the skin (apart from what is termed the chromatic function, or the indirect influence of light through the eyes) enhances the metamorphosis of tissue. Dr. Weber concludes that one use at

least of the chromatophores is to diminish the transparency of the skin and thus to lower the action of even moderate light when it begins to affect injuriously the organism.

THE METAMORPHOSIS OF PENEUS.—Dr. W. K. Brooks, in his account of the metamorphosis of Peneus (Johns Hopkins University Circulars, Nov., 1882), noticed in the January number of the NATURALIST (p. 90), says:

"Those familiar with the literature of the subject will recollect that Fritz Müller kept under observation until it changed into a protozoëa, a nauplius which he captured at the surface of the ocean. He also secured, in the ocean, a very complete series of larvæ, through which he identified his protozoëa with a young Macrouran with the characteristics of the genus Peneus. He did not rear the nauplius from the Peneus egg, nor did he actually observe the transformation into the young Peneus. Certain over-cautious naturalists have therefore refused to accept his conclusions until more conclusive proof should be furnished."

Dr. Brooks then proceeds to state that he has captured the protozoëa of Peneus and reared it in confinement, witnessing every one of the five molts between the youngest protozoëa and the young Peneus. "The whole metamorphosis of Peneus has therefore been actually witnessed and there is no longer any room for criticism."

If Dr. Brooks will read Fritz Müller's two papers on the subject (Arch. Naturgesch., Bd. XXIX., Zeitschr. wissensch. Zoöl., Bd. XXX), he will learn that Müller did *not* keep the nauplius under observation until it changed into a protozoëa, but that he captured the protozoëa in the sea and inferred its relation with the nauplius from its likeness in movements, color and structure. This assumed relation between the protozoëa and the nauplius "certain over-cautious naturalists" wished to see proved either by hatching the nauplius from the egg of Peneus, witnessing the transformation of the nauplius into the protozoëa, or discovering intermediate stages between the nauplius and the protozoëa. Brooks' observations have no bearing on the question whatever. He has proved the connection between the stages older than the nauplius. That the nauplius belongs to the same series, he has not shown. In fact, his youngest protozoëa is an older stage than the youngest protozoëa secured by Müller. He has riveted the links in Müller's chain that were closely joined before, but has not touched the weak spot!

From the complete disappearance of the exopodites from the five pairs of legs and the simplicity of the abdominal appendages in the oldest stage observed, it would appear that Brooks' larva belongs to the genus Sycionia rather than to Peneus.

The larval stages of the Peneidæ seem to be not uncommon in the warmer seas. Besides the published figures of Müller

and Claus, I have seen drawings of the developmental stages, from the protozoëa onward, made by Mr. Alexander Agassiz at the Tortugas islands in 1881, and by Mr. J. W. Fewkes, at the Bermudas, in 1882. No observer has re-discovered Müller's nauplius; yet in the light of our knowledge of the development of Mysis, Euphausia and Lucifer, I see no good ground for refusing to accept Müller's reasons for believing his nauplius and zoëa stages to be parts of one life-history.—*Walter Faxon, Cambridge, Mass., March 9, 1883.*

Discovery of Eurypauropus in Europe.—Dr. R. Latzel, of Vienna, writes us under date of February 23, that last summer he discovered in Austria the genus Eurypauropus of Ryder. It is there represented by two species, the rarer one of which is very similar to *Eurypauropus spinosus* Ryder. He has also detected *Pauropus huxleyi* of Lubbock. We believe this is the first time Pauropus has been detected on the continent.

Repugnatorial Pores in the Lysiopetalidæ.—Having received, through the kindness of Dr. Latzel, specimens of *Lysiopetalum carinatum* Brandt, from Dalmatia, which is a very large species, I have been able to examine the repugnatorial pores, which are very distinct, their crateriform openings being situated each between two ridges on the anterior edge of the raised portion of the scute. In *L. illyricum* Latzel, from Austria, they are with difficulty perceived, the area in which they are situated not being discolored with yellow; but they can be detected with a half-inch objective. The two European species mentioned are provided with setæ, while our *L. lactarium* is naked. In the latter species the repugnatorial pores are situated in the middle of the yellow lateral spot, between two carinæ, which are higher and closer together than any of the others. They can be seen with a Tolles triplet.

Reëxamining the cave Lysiopetalid, *Pseudotremia cavernarum* Cope, from Wyandotte cave, and a variety *carterensis* which inhabits the Carter caves, Ky., I cannot with certainty discover their site, as they are nearly, if not quite, obsolete. It is possible that in cave species, where there are apparently no enemies of these Myriopods, their pores become at least externally obsolete.—*A. S. Packard, Jr.*

Poison-apparatus of Scorpions.—M. Joyeux-Laffuie finds that the poison organ of the scorpion (*S. occitanus*) is formed by the last abdominal segment, where two small oval orifices serve for the exit of the poison; there are two glands, equal in size, and symmetrically arranged; each occupies a space, covered externally by the chitinous skeleton, and having internally an interior and posterior membrane, formed by striated muscular fibres, which are inserted into the chitinous skeleton. By their contraction the poison is forced outwards. The wall of the gland consists of a

delicate layer, formed by cellular tissues and smooth muscular fibres; on its internal surface there are projecting lamellæ, which increase the extent of the secreting surface; below this, is a layer of prismatic cells, which are filled with protoplasm, containing in suspension, and in abundance, fine rounded granulations, which are characteristic of the poison of the scorpion, and hide the nuclei, which only become apparent on the addition of acetic acid; these are the cells which elaborate the poison, and from which it escapes, by the rupture of the cells, into the central cavity of the organ.

Physiologically, this poison is very active, and that in direct relation to the quantity introduced; one drop is soon fatal to a rabbit and still more active on a bird; seven to eight frogs may be killed by one drop, and the hundredth part of one is fatal to an ant of large size. It would appear to affect the nervous system, and has undoubtedly a marked action on striated muscle, suppressing spontaneous and reflex movement.—*Journal of the Royal Microscopical Society.*

The Habits of the Snake Bird.—The mechanism of the neck in the darters (Plotus) is treated by W. A. Forbes in the Proceedings of the London Zoölogical Society. The darters feed entirely, so far as Mr. Forbes had been able to observe, under water. "Swimming with its wings half expanded, though locomotion is effected entirely by the feet, the bird pursues his prey (small fishes) with a peculiar darting or jerking action of the head and neck, which may be compared to that of a man poising a spear or harpoon before throwing it. Arrived within striking distance, the darter suddenly tranfixes, in fact, bayonets, the fish on the tip of its beak with marvelous dexterity, and then immediately comes to the surface, where the fish is shaken off the beak by jerking of the head and neck (repeated until successful), thrown upward, and swallowed, usually head first." A study of the neck in the recently dead bird leaves little doubt as to the mechanism by which this peculiar impaling of the prey is effected. The eighth cervical vertebra is articulated with the seventh in such a way that the two cannot naturally be got to lie in the same line, but form an angle, open forwards, of about 145°, when the two bones are stretched as far as possible in that direction. After further describing the mechanism, Mr. Forbes thus concludes his paper: "It is obvious that considerable advantage is gained by the action in question, the rapid protrusion of the narrow neck and head over a small space by this mechanism necessitating a less amount of exertion than would a similar movement of the whole bird over the same space, and being equally efficacious in striking the prey. The whole mechanism, it may be observed, exists in a less developed form in the neck of the herons, cormorants, etc.; and it requires but a slight modification of the arrangement of these parts in those birds—none of which, so far as I know, impale their prey like

the darters—to bring about the perfect adaptation of these structures to a newly acquired mode of feeding. Mr. Forbes' observations refer to the Indian darter (*Plotus melanogaster*), but will undoubtedly apply to our Anhinga bird.

ZOOLOGICAL NOTES—*Protozoans.*—The *Journal de Micrographie* for February contains illustrated reports of Professor Balbiani's lectures at the College du France on unicellular organisms, also continues the report of his useful course on Sporozoa, finishing his account of the Coccidies. Dr. Pelletan, the editor, publishes an account of the reproduction by division of *Dinobryon stipitatum.*——Some interesting Infusoria are described by A. Gruber in the last number of *Zeitschrift für wissen. Zoologie.*——H. O. Brady describes Keramosphæra, a spherical porcellanous foraminifer analogous to Orbitolites and dredged about twenty-five degrees south of the south-western corner of Australia, by the *Challenger* (*Annals and Mag. Nat. Hist.*).

Sponges.—Mr. H. J. Carter describes several new sponges, and proposes the group of Phlœodictyina for certain species having a laminated and concentric structure. The green color of Spongilla is situated in the little spherical granules of the sponge-cell. ——Mr. Stuart O. Ridley describes four new Primnoans and Gorgonians from the Mauritius.

Cœlenterates.—The arrangement of the family Coralliidæ, to which the red coral of commerce belongs, has been discussed by S. O. Ridley in the Proceedings of the Zoölogical Society of London. These alcyonarian corals are chiefly remarkable for possessing a continuous stony axis, covered by only a thin cortical layer of a softer spiculiferous material, into which the polypes are retractile. Precious coral, probably all derived from the Mediterranean, is used by the Chinese and Japanese as ornaments, a Chinese empress's necklace having been made of alternate pieces of jade and coral.——One of the most interesting results of the studies of MM. A. Kowalevsky and A. F. Marion on the development of the Alcyonaria, was the great difference observed in the order of the appearance of various parts in Sympodium. In some larvæ of delayed fixation the dissepiments were sketched out while the vermiform stage persisted, and the ectoderm had developed mesenteric folds and a section almost identical with that of an Actinia, while yet no sclerites was forming. In the same laying were normal larvæ that were quickly transformed.

Worms.—Dr. J. Barrois publishes (*Ann. and Mag. Nat. Hist.*) an attempt at a general theory of the embryogeny of the Bryozoa (Polyzoa), founded upon the study of their metamorphoses. This observer states that the relations between the larva and the adult have not before been fully made out. In the Entoprocta there is a very complete passage, though in a complex manner, of the organs of the larva into those of the adult. In the Ectoprocta

the larvæ are more different from the adult form. The development of the mantle in the larvæ and the reduction of the internal organs which accompanies it, are a series of purely *adaptive* characters. Dr. Barrois believes that the entoproct larva represents the ancestral type of the entire group, remarks that such a larva is constructed on the same plan as a rotifer, and conceives of the original formation of a Bryozoan *as resulting from a simple change of life* in an organism resembling a Rotifer. The Probryozoa, in his hypothesis were free-swimming organisms possibly analogous to the Rotifera.——Professor M'Intosh describes Cephalodiscus, a singular polyzoan dredged by the *Challenger* in the Straits of Magellan, and allied to Rhabdopleura (*Ann. and Mag. Nat. Hist*).——The Rev. T. Hincks, in his sixteenth "Contribution towards a General History of the Marine Polyzoa" (*Ann. and Mag. Nat. Hist.*) describes six new species, and in his notice of the Polyzoa of the Queen Charlotte islands give preliminary descriptions of thirty-four species.——Mr. W. A. Haswell (*Ann. and Mag. Nat. Hist.*) states that the elytra of the aphroditarean annelids are connected with the functions of (1) protection; (2), production of phosphorescent light; (3), sensation, and (4), incubation. In *Iphione* the scales are dense, causing the animal to resemble a chiton. As they are provided with abundant nerves, they are probably the seat of some special sense. The ova are carried by ciliary action to the under surface of the scales, where they adhere till the embryos are well advanced. Impregnation probably takes place while the eggs are in this position.——M. A. Giard (*Comptes Rendus*) describes an annelid with synthetic characters uniting the Lycoridea (to which it is closest) with the Hesionea and Polynoë, on the one hand, and with the Syllidea on the other. It inhabits a sort of tube formed by the raised lateral margins of the thoracic region, upon the dorsal aspect of a Balanoglossus (*B. robinii*), which at the Iles Glenans attains a meter or more in length. The proboscis is entirely unarmed, which is remarkable in a Lycoridian.

Mollusks.—It appears that in Ceylon *Helix hæmastoma* is protected from observation by being covered with a growth of alga, which likewise grows on the trunks of the palms it frequents. *Helix superba* also has a similarly green protective coating, rendering it less visible to passing birds.——An important illustrated article on the vascular and water-receiving system of the Unionidæ and Mytilus, by Dr. H. Griesbach, appears in the *Zeitschrift für wis. Zoologie* of Feb. 20, 1883.

Crustaceans.—Professor F. A. Forel, *Ann. and Mag. Nat. Hist.*, enumerates the Entomostraca that constitute the pelagic fauna of fresh-water lakes, a fauna that in its general features is the same from Scandinavia to Italy and the Caucasus, and from the plains to the Alps. A complete list of the species inhabiting a lake

cannot be made at any one season, as the Cladocera periodically disappear and occur at the bottom in the state of resting-eggs. As these pelagic creatures can never rest on a solid body, they have highly developed swimming organs and a light specific gravity, yet they are sluggish, and escape destruction rather by their perfect transparency than by their motions. Some feed on Algæ, but most on animal food. During the night they swim upon the surface, but in the day descend into the depths. All have a strongly pigmented black, brown, or red eye. Professor Forel believes that the regular wind which at night blows from the land to the water has been the cause which has kept a certain portion of the entomostracous fauna of the lakes to the pelagic area until it has become modified to suit its surroundings. As the creatures sink during the day, they escape the breeze that then blows towards the land.

Vertebrates.—At the close of a valuable paper in the Proceedings of the Zoölogical Society of London, on the colors of feathers, Dr. H. Gadow sums up his conclusions as follows: We have to distinguish between several categories of colors in feathers. 1. *Objective chemical colors*, directly produced by pigment. To these belong black, brown, red, orange and yellow. 2. *Objective structural colors.* The feathers may contain no pigment at all, and the color be produced solely by special structural arrangement of the feather-substance, for instance, white, and frequently yellow; the latter, if the surface is composed of very fine and narrow longitudinal ridges. Or the feather contains a yellow to brownish-black pigment, and the color actually observed, as *green*, *blue* and *violet*, is produced by a specially produced and particularly constructed transparent layer between the pigment and the surface of non-changing colors; *blue* and *violet* are always structurally objective. *Green* seems to be only in a few cases the result of yellow pigment combined with blue surface-structure. In most cases it seems to be not a mixture of two colors, but due to yellow-pigment light being broken into green. A green pigment seems to be very exceptional. 3. *Colors which change and which entirely depend on the position of the light and eye.* They are produced by a transparent sheath, which acts like a prism. Any changing color represented in the solar spectrum may be thus produced in feathers.——Professor W. Peters, in the Proceedings of the Royal Prussian Academy of Science, describes *Agamodon anguliceps*, an Amphisbenoid with teeth which differ from those of other Amphisbænidæ in this respect; in other species the teeth are inserted on the inner side of the jaw, so that on turning back the gums their entire length can be seen; while in Agumodon the teeth, as in Agamidæ and chameleons, grow from the border of the jaw, so that only their projecting portion can be seen. The examples were brought from Barava, on the northern part of the east coast of Africa.——In the same Proceedings Professor Peters

describes *Opisthoplus degener*, a new genus and species of snake, with the maxillary edentulous, except at its posterior extremity, where it bears a very long sulcated tooth. The same naturalist, in conjunction with G. Doria, describes *Zoötoca atlantica* from the Canary isles.——Dr. Bean notices in the Proceedings of the United States National Museum a collection of birds made by him in the summer of 1880 in Alaska and Siberia.——L. Stejneger publishes in the same Proceedings outlines of a monograph of the swans, and Mr. L. M. Turner describes some variations in *Lagopus mutus* and its allies from the Arctic regions, especially the western coast of Arctic America.

PHYSIOLOGY.[1]

PHYSIOLOGICAL AUTOMATICITY.— Automatic and spontaneous movement is one of the powers of undifferentiated protoplasm, but it has been generally supposed that among the higher classes of animals all automatic and spontaneous actions are brought about by impulses proceeding from certain nerve cells. Thus the contractions of the heart, which still proceed with a definite rhythm after the organ is removed from the body, are supposed to be excited by rhythmic discharges from the nerve cells, which are contained within the cardiac walls. Dr. Gaskell has lately shown, however, that when a slender strip of muscle, perfectly ganglion free, is cut from the apex of a tortoise's heart and hung up in a moist chamber, after the lapse of some four hours the strip commences to contract rhythmically and may continue thus automatically active for some twenty to thirty hours. The initial period of quiescence which follows the suspension may be shortened about one-half if the strip of muscle be stimulated at intervals by a very feeble electrical current. "Every part of the muscular tissue of the tortoise heart possesses the property of spontaneous rhythmical contraction, and the difference in function between the muscular tissue of one part and that of another depends upon the extent to which that property has become on the one hand specially developed or on the other hand rudimentary, owing to the greater development of some other property, such as rapidity of contraction, which was more advantageous for the efficiency of the heart as a whole. In the muscular tissue of the frog's ventricle this rhythmical property seems to be still more rudimentary than in the tortoise."—*Proc. Cambridge Phil. Soc. Vol. iv, pt. 5.*

THE PRODUCTION OF THE SECOND HEART SOUND.—"In the twenty-third volume of Pflüger's Archiv, Professor S. Talma describes experiments which show that the sound produced by the sudden tension of a membrane, loosely stretched across the lower end of a vertical tube filled with water, varies in pitch inversely

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

as the height of the fluid column. Hence he infers that the sound comes from the fluid and not from the membrane. Further, that as the membrane is subjected to unequal pressure on its opposite sides, is in fact distended by the weight of the water, it is not able to produce sonorous vibrations. He then concludes that the second sound of the heart, which is produced by the impact of a fluid column, the arterial blood, against membranous septa, the semilunar valves, originates in the vibration of the blood, and not of the valves."

On repeating these experiments by a modified method, C. E. Webster concludes that the second sound of the heart is the combined result of the vibrations both of the fluid blood column and of the membranous semilunar valves.—*Journ. of Physiology, Vol. iii, p. 294.*

A Simple Method of demonstrating the Alkaline Reaction of the Blood.—A drop of blood, obtained by pricking the finger, is placed upon the smooth colored surface of a piece of the dry, faintly reddened, *glazed*, litmus paper, and after a few seconds is wiped off with the corner of a handkerchief or clean linen rag moistened with water. The place where the blood has stood is seen to be marked out as a well-defined blue patch upon the red or violet ground. Nothing can be clearer or more convincing than the demonstration of the natural alkalinity of the blood which is afforded by this simple experiment.—*E. A. Schäfer, Journ. of Physiology, Vol. iii, p. 292.*

Influence of Light upon Bacteria.—Th. W. Engelmann describes a new form of Bacterium, called by him *B. photometricum*, which exhibits some remarkable reactions toward light. This bacterium moves only when illuminated, coming to a state of rest or motion according as it is removed from or is brought into the light.

Access of oxygen is favorable and probably necessary to motion, but the gas has not the stimulating effect of sunlight. The rapidity of movement increases proportionately with the intensity of illumination, and motion gradually ceases on removal from the light. Long continued action of very strong light, especially when little oxygen is present, brings the Bacteria to rest. Sudden diminution in the intensity of illumination produces remarkable agitation, such as rapid rotary movements. When the field of the microscope is partially shaded the Bacteria are seen to accumulate in the brighter portions, actively avoiding the dark parts of the field. This sensitiveness to differences in illumination was greater or less respectively as the supply of oxygen was diminished or increased.

When the field of the microscope is illuminated by pure spectral colors, most of the Bacteria wander into the region of the ultra-red rays where they are heaped in a narrow, sharply bounded

band. A smaller number collect under the yellow and orange rays and form there a pretty well-defined band. The few remaining forms are scattered in the more refrangible parts of the spectrum and more especially in the green rays. For the violet rays the limits of sensitiveness of the Bacteria is not far from that of the human eye, but their appreciation of the ultra-red rays goes much beyond that of the eye. It is the ultra-red rays that are most abundantly absorbed by the Bacteria and which act most powerfully in exciting them to motion.—*Pflüger's Archiv., Bd. 30, S. 95.*

The Diastatic Action of Saliva.—It has generally been believed that the activity of the ferment *ptyalin*, which in normal human saliva rapidly turns starch into sugar, was arrested when the alkalinity of the saliva was neutralized or the fluid made slightly acid, and that therefore the conversion of starch of the food into sugar, which is begun in the mouth, was completely arrested when the food reached the acid juice of the stomach. The late work of Chittenden and Ely (*Journ. of Physiology*, Vol. III, p. 337), and of Langley and Eves (*Ibid*, Vol. IV, p. 18) has shown that the diastatic action of neutralized saliva is more rapid than that of the normal fluid, and that the addition of very minute quantities of sodium carbonate has a destructive effect upon the ferment. The former authors found that the addition of a small amount of acid, .025 p. c. HCl, destroyed to a great extent the starch converting power of saliva, but that when a small quantity of peptone was also added, the diastatic action of the ferment was increased above the normal. Langley and Eves point out that the peptones probably exert their favorable influence through combining with the free acid added to the saliva, thus preventing its destructive influence upon the ptyalin; for they find that the slightest amount of free acid in the mixture arrests the ferment action.

There is good reason to suppose that the gastric juice secreted during the first three-fourths of an hour after the beginning of digestion contains little if any free acid; so it is highly probable that the diastatic action of saliva continues for some time after the entrance of food into the stomach, though it seems certain that the salivary ferment is finally destroyed by the acid contained in the gastric juice.

Varying the Thermal Background of Reflex Perception.—The background of conscious perception, physiologically speaking, is defined by W. T. Sedgwick as "that standard (usually unconsciously held) with which we compare any stimulus which awakens consciousness." We perceive difference of relative intensity between a specific stimulus and its background. The latter may vary so that a stimulus which will to-day cause consciousness or motion will not do so to-morrow. Instead of studying

the reflex background by means of inhibitions, the author varies the background as a whole thermally, and observes its effect on reflexes. A reflex or headless frog may be heated so slowly that although the heart may beat very fast, *rigor caloris* may be caused without any motor reaction of its limbs. If the heart be tied before hand, reflexes occur from gradual heating. This the author thinks explained by assuming that in the first case the hot blood passing inward equalizes the progressive heating throughout, or changes the thermal background; while in the second case, with no circulation, the background is fixed and the surface temperature rises to the point of difference which causes movement.—*Science, Vol. i, No. 5, p. 152.*

Action of Digitaline on the Circulatory Organs.—(Preliminary note by H. H. Donaldson and L. T. Stevens). The continuation of the experiments begun last year has yielded the following results: The work done by the heart of the common frog is decreased by digitaline, whatever the dose, as was previously shown to be the case for the heart of the "slider" terrapin. In both frog and terrapin, the decrease occurs, whether the aortic valves are intact or not. Variations in arterial or venous pressure do not affect the result.

By a method permitting direct measurement of the fluid circulating through the viscera and lower extremities in a unit of time and under constant pressure, it has been determined for the frog that the arterioles are constricted by digitaline. On this point the terrapin has not yet been investigated. Digitaline has also been shown to increase mean blood pressure in both frog and terrapin. We have, then, for the frog under digitaline a decrease in the work done by the heart, a rise of mean blood pressure, and a constriction of the arterioles. The first and second of these points have been already demonstrated for the terrapin as well.—*Science, Vol. i, No. 5, p. 149.*

Perception of Light and Color by the Lowest Plants and Animals.—The instances in which these faculties are exhibited in the lowest forms even extending to some true plants, are very numerous, but hitherto have met with little explanation. T. W. Engelmann suggests three principal modes by which light is able to affect these organisms, viz: 1. Directly, by modification of the interchange of gases, without apparent addition of sensation. 2. By modification of the sensation of necessity for breathing, owing to modification of the interchange of gases. 3. By setting up a specific process, which probably answers to our sensation of light. Of these the first may occur either alone or in combination with the second; simultaneous occurrence of the first and third may possibly take place.

1. Navicula is taken as the type of the first method, and most mobile Diatomaceæ and Oscillarineæ belong to the same class.

Movement is here intimately connected with the presence of free oxygen, which, if not present, can be produced by these organisms in the light.

2. *Paramœcium bursaria.* When the proportion of oxygen is normal, or somewhat greater than the normal amount, the infusorian is usually very quiet; if, however, it sinks ever so little below this degree, the animal becomes restless, and makes for places in which there is more oxygen (*e. g.*, edge of cover-glass); in good light, but under otherwise similar conditions, the specimens distribute themselves equally throughout the drop. Active swimming is the consequence of serious diminution of the oxygen; if strong light is then applied for some minutes, the Paramœcium courses rapidly about, and if insufficient supplies of oxygen are added from without, it shows itself very sensitive to alterations in the illumination in the spectrum; it prefers red of between the lines B. and C. High tension of oxygen reacts strongly on the movements, for the animals then tend to swim straight or in wide curves away from the point at which oxygen is present in abundance. Strong illumination applied suddenly at this time causes violent movements, and the Paramœcium often darts into the darkness, exhibiting the phenomenon of protophobia. Thus this animal is highly sensitive to differences in the tension of oxygen.

3. *Euglena viridis* is taken as the third type. Here the tension of oxygen has little to do with the movements. When the drop of water is partially illuminated the Euglenæ gradually assemble in the lighted area, and usually remain there; if a shadow is thrown upon the anterior chlorophyll-less portion of the body the animal turns and behaves as if wholly in darkness. This is not due to the eye-spot which is placed here, as the reaction is affected when the darkness first reaches the protoplasm outside it. This sensitiveness of the anterior end of the body is generally distributed amongst animals, and occurs in *Paramœcium bursaria*, in spite of the greater amount of chlorophyll contained in the posterior part. Engelmann has not as yet succeeded in finding blind or color-blind Euglenæ, but individuals from different localities and in different stages of development often show important variations in their sensitiveness to light.—*Journal Roy. Microscopical Society, Feb.*

PSYCHOLOGY.

ROMANES' ANIMAL INTELLIGENCE.[1]—Our purpose in noticing this excellent book is rather expository than critical. We will first notice the introduction to the work, and in subsequent paragraphs give the author's statements as to our present knowledge of the mental endowments of the different groups of animals in

[1] Animal Intelligence. By George J. Romanes. International Scientific Series. New York, D. Appleton & Co., 1883, 12mo, pp. 520.

the ascending order, as it is undoubtedly the freshest and, in most respects, best work of the sort at our command. Mr. Romanes, in the present volume, brings together the leading facts bearing on the instincts and reasoning powers of animals; in a second volume he proposes to consider the facts of animal intelligence in their relation to the theory of descent; in other words to the evolution of mind in animals and man.

The present volume is largely made up of anecdotes about animals, and as such will find many readers, as the subject is one of much popular interest. Many of the anecdotes are, however, fresh and pertinent, and while the author has, so far as possible, endeavored to suppress anecdotes, he has found it of course impossible not to give most of his space to them. He has been fortunate in having had placed at his command, by Mr. Darwin, shortly before his death, "all the notes and clippings on animal intelligence which he has been collecting for the last forty years, together with the original MS. of his wonderful chapter on 'Instinct.'" "This chapter," adds Mr. Romanes, "on being recast for the 'Origin of Species,' underwent so merciless an amount of compression, that the original draft constitutes a rich store of hitherto unpublished material." In his second work he proposes to draw upon this store more largely than in the present one.

In the introduction Mr. Romanes lays down the general principles upon which he constructs his work. His criterion of mind is as follows: "Does the organism learn to make new adjustments, or to modify old ones, in accordance with the results of its own individual experience? If it does so, the fact cannot be due merely to reflex action in the sense above described, for it is impossible that heredity can have provided in advance for innovations upon, or alterations of, its machinery during the life time of a particular individual."

Rejecting the theory of animal automatism on the ground that it can never be accepted by common sense, he claims that as a philosophical speculation "by no feat of logic is it possible to make the theory apply to animals to the exclusion of man." He insists that the mind of animals must be placed in the same category as the mind of man. The proof is the fact that an animal is able to learn by its own individual experience. "Wherever we find an animal able to do this, we have the same right to predicate mind as existing in such an animal that we have to predicate it as existing in any human being other than ourselves."

The author then attempts to draw the line between reflex and instinctive action. This line, he thinks, "is constituted by the boundary of non-mental or unconscious adjustment, with adjustment, in which there is concerned consciousness or mind."

Finally Mr. Romanes thus defines reflex action, instinct and reason:

"Reflex action is non-mental neuro-muscular adjustment, due

to the inherited mechanism of the nervous system, which is formed to respond to particular and often recurring stimuli, by giving rise to particular movements of an adaptive though not of an intentional kind.

"Instinct is reflex action into which there is imported the element of consciousness. The term is therefore a generic one, comprising all those faculties of mind which are concerned in conscious and adaptive action, antecedent to individual experience, without necessary knowledge of the relation between means employed and ends attained, but similarly performed under similar and frequently recurring circumstances by all the individuals of the same species.

"Reason or intelligence is the faculty which is concerned in the intentional adaptation of means to ends. It therefore implies the conscious knowledge of the relation between means employed and ends attained, and may be exercised in adaptation to circumstances novel alike to the experience of the individual and to that of the species."

These definitions, are, it seems to us, an improvement, in most respects, on any which have yet been made, though in that of instinct the idea that instinct is the sum of inherited, originally conscious habits, might have been more distinctly emphasized. J. J. Murphy's definition, to which Romanes does not refer, that "instinct is the sum of inherited habits," is neat and terse. The facts recorded in the different chapters are arranged not under reflex, instinctive and rational actions, as we should have expected, but roughly under the general heads of general intelligence, memory, &c. Chapters are devoted to ants, bees, wasps, the dog, cat and monkey.

Of course any one can supply a number of published anecdotes and statements which the author has omitted; perhaps from lack of acquaintance with the literature, so scattered and often inaccessible. While speaking of the architectural habits of the hive bee, one wonders that the author had not acquainted himself with the late Professor Wyman's remarkable paper on the cells of the honey bee, as well as Reaumur and Maraldi's observations, but these, perhaps, were beside his purpose. Mr. Dall's article in this journal (Dec., 1882) on the intelligence in a snail and its power of recognizing a call or sound, and of distinguishing it from other sounds, was overlooked. As regards the intelligence of crabs, the case of "homing" instinct noticed by an English observer, would have been in place. A number of typographical errors somewhat mar the book.

On the whole, the work is an excellent contribution to the subject, though we must confess to a shade of disappointment felt here and there as to the method of treatment, as from the author's other writings we had expected something a grain better. He has, moreover, failed to notice some authors who have antici-

pated his views on various points. We shall look with interest for the second work on "Mental Evolution," which demands powers of high order for its successful treatment.

INTELLIGENCE IN PROTOZOA.—Romanes in his "Animal Intelligence" says, "No one can have watched the movements of certain Infusoria without feeling it difficult to believe that these little animals are not actuated by some amount of intelligence." He then describes the means taken by a large rotifer to shake off a smaller individual which had fastened itself by its forceps to the former. He claims that the beginnings of instinct are to be found so low down in the scale as the Rhizopoda. He quotes from Mr. H. J. Carter, who says: "Even Athealium will confine itself to the water of the watch-glass, in which it may be placed, when away from sawdust and chips of wood among which it has been living; but if the watch-glass be placed upon the sawdust, it will very soon make its way over the side of the watch-glass and get to it."

He then cites the actions of the Actinophrys in getting its food, and of Amœba in seizing its prey, young Acinetæ, but concludes that we should not "be justified in ascribing to these lowest members of the zoölogical stage any rudiment of truly mental action.

ANTHROPOLOGY.[1]

THE CARSON FOOTPRINTS.—In the area of an excavation made for the foundation of the penitentiary at Carson, Nevada, are impressions in the sandstone that are probably footprints. The most remarkable among these is a series which have been supposed to be the tracks of giant human beings, the ancestors of the present human race. Dr. Walter J. Hoffman visited the site last fall in the interest of the Bureau of Ethnology, and brought to Washington a cast of one of the depressions. Dr. Hoffman's conclusions, in a communication to the New York *Weekly Herald* (Nov. 18), are as follows: "The only animal capable of producing impressions any way similar to these are the bear and the Mylodon, or gigantic ground sloth. They are neither of these, and the theory gaining most followers is that 'it is the missing link in the chain of human evolution.'" A note in the last number of *Revue d'Anthropologie de Paris* rehearses Dr. Hoffman's researches, and expatiates on the evidence of the existence of Tertiary man. Mr. G. K. Gilbert, of the U. S. Geological Survey, has received from Mr. Russel a skilled observer on the spot, some valuable information upon these footprints, which he communicated to the Washington Anthropological Society. Mr. Russel confirms Prof. Cope's determination that the beds are Upper Pliocene or Lower Quat-

[1]Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

ernary, and is convinced that the tracks are those of the Morotherium, an edendate. It is but just to Dr. Hoffman to say that the opinion stated above is that of the people of Carson, and by no means his own. The impression, of which a cast was taken by him, is not a track at all. The mud was so soft that the animal's foot sunk into it, pushed a ridge upwards two or three inches higher than the outside level, and came out with a mass adhering to it. Consequently no marks of claws or skin creases are to be looked for. Very few doubt at this time the antiquity of man, but the evidence may be weakened by too earnest pleading on the part of its advocates.

COREA: THE HERMIT NATION.—In May of the past year Commodore R. W. Shufeldt negotiated a treaty between the United States and Corea. In a few weeks commercial relations were established with Great Britain, France and Germany. The opening of this last of the exclusive nations to familiar intercourse with the civilized world, has excited the curiosity of ethnologists to know more of the peninsula. Its anthropological boundaries, at present, are as follows: On the north by the Mantchus and the Asiatic Russians; on the east and south by the Japanese; and on the west by China and Chinese Tartary. Wishing to obtain the most reliable and detailed information respecting the aboriginal inhabitants of the country, the influence of the environing peoples upon Corea, the part which Corea has played in the civilization of her neighbors, the detailed account of her historic evolution, the story of the Jesuit missions in the last century, and finally the resources of the peninsula, we chanced to read a volume published by Charles Scribner's Sons, of New York, entitled "Corea: The Hermit Nation," by William Elliot Griffis. The work is divided into three parts: 1. Ancient and mediæval history; 2. Political and social Corea; 3. Modern and recent history. Of the aborigines nothing is known. "Like the three kingdoms of England, Scotland and Wales, the Corean States were distinct in origin, were conquered by a race from without, received a fresh infusion of alien blood, struggled in rivalry for centuries, and were finally united into one nation, with one flag and one sovereign." To the sociologist the chapters on government, feudalism, serfdom, social order, woman and the family, child-life, housekeeping, diet, costume, mourning and burial, employments, mythology, folk lore and culture, will furnish new and valuable information. Those who regard Manco-Ccapac, Quetzalcoatl and their congeners to have been real persons, will find some comfort in chapter XXII, entitled "The Dutchmen in Exile," wherein the story of Will Adams, an Englishman held by the Japanese, and of John Wetterree, a Dutchman similarly treated by the Coreans, is carefully detailed. The influence of Confucianism and Buddhism is well described.

CONTRIBUTIONS TO NORTH AMERICAN ETHNOLOGY.—The fifth volume of Major Powell's quarto series upon North American ethnology has just issued from the Government press, though bearing the imprint of 1882. It is simply three quarto monographs bound together and sent forth to the literary world upon their own merits without introduction, as follows:

Observations on cup-shaped and other lapidarian sculpture in the old world and in America. By Charles Rau.

On prehistoric trephining and cranial amulets. By Robert Fletcher, M. R. C. S., Eng., Act. Asst. Surg. U. S. A.

A study of the Manuscript Troano. By Cyrus Thomas, Ph. D. With an introduction by D. G. Brinton, M.D.

The first paper has undergone no changes since it first appeared, save a few literary corrections at the hand of the author.

The second paper has not previously been noticed in this journal. Some may wonder why a work of this kind is published by the Government. A celebrated chief of one of our late surveys once saw a splendid manuscript upon a family of South American birds, with gorgeous illustrations. Hankering after it for "my publications," he inquired at the Smithsonian Institution whether a single species of the family had ever been seen in the Rocky mountains. "If they have," said he, "I will publish the manuscript." There have been cases of perforations in aboriginal crania in America—in Peru, in Michigan and in Illinois. We have the species, therefore, to hang the family on and to justify the publication. Furthermore, Dr. Fletcher is, perhaps, the only man in America who could have written this interesting paper, being the active editor of the *Index Medicus* of the Surgeon-General's office, and handling the whole body of the medical literature of the world.

The third paper, already mentioned, is illustrated by four *fac simile* colored plates, five uncolored plates and 101 figures in the text.

Each monograph has its own copious table of contents and index.

A NEW AFRICAN SPEECH.—Commenting upon Dr. Gustav Nachtigall's second volume on Sahara and Sudan, Mr. A. H. Keane draws attention to the Tubu people of the East Sahara, that is, "people of Tu," or Tibesti, identified by Lepsius with the Garamantes of Herodotus (IV, 183), whose capital was Garama (Edrisi's Germa) in Phazania (Ferzan). Lepsius recognizes in Africa only two fundamental racial and linguistic groups, and regards the Tubus as originally Negroes assimilated physically to the Berbers, while retaining their primitive Negro speech. Dr. Nachtigall shows that this group is distinct from Bantu and quite as radically separate from the northern Hamitic stock. But, out of deference to the great authority of Lepsius, seeks to save the

theory of the latter by tentative explanations. Mr. Keane, however, boldly affirms that Dr. Nachtigall's inquiries have resulted in "the discovery of an independent and widespread linguistic family." The most archaic form is the Teda or northern Tubu, and the offshoots are the Dasa, the Kanem—north of Lake Tchad, the Kanuri of Bornu, the Baele of Ennedi and Wanyanga, and the Zoghawa of North Darfur. More distant members appear to be the Hausa, Fulu and Sourhay of West Sudan, the Logon, Bagrimma (Baghirmi) and Mandara (Wandela) of the Shary basin, and the Maba of Wadai.—*Nature, March 1, 1883.*

THE PEABODY ACADEMY OF SCIENCE.—In the town of Salem, Mass., was incorporated, in 1867, the Peabody Academy of Science, formed by the union of the East India Marine Hall, the Essex Historical Society and the Essex Institute, and blessed with a fund of $140,000 from Mr. Peabody. In former times the sailors of Salem visited all the most remote points of the earth, when unadulterated aboriginal implements were plentiful and could be had for a "song." These hardy men always remembered their museum, and consequently the collection is very rich in foreign material. The present officers are Wm. C. Endicott, president; A. C. Goodell, secretary; John Robinson, treasurer; and E. S. Morse, director. A very full account of the museum will be found in Cassino's Scientific and Literary Gossip, Boston, Mass.

ARCHÆOLOGY OF ILLINOIS.—The third annual meeting of the State Natural History Society of Illinois was held in Champaign on the 28th Feb., 1882. The following communications upon the natural history of man were made: 1. Primitive religion in America, by Hon. Wm. McAdams, of Jerseyville; 2. Prehistoric remains in South-eastern Missouri, by F. S. Earle; 3. The great Cahokia mound, by Wm. McAdams.

THE WYOMING HISTORICAL AND GEOLOGICAL SOCIETY.—Publication number 4 of the above-named society is a very neat pamphlet of letter-press and heliotype plates, descriptive and illustrative of seven fine old aboriginal pots, all found in Pennsylvania excepting one. It does not often fall to our lot to be pleased with archæological illustrations, so a little extravagant admiration must be pardoned. Imagine a full page devoted to each specimen, beautifully represented, and the opposite page to contain all that is said about the reverend vase, and you will have a slight conception of the pleasure that awaits you in reading publication number 4.

THE INDIAN OFFICE REPORT.—If those who had dealings with the Indians from the earliest times could have foreseen the wants of the Naturalist and of the Smithsonian Institution, Bureau of

Ethnology, Peabody Museum, Archæological Institute, &c., what charming and useful books they could have written. The same is true of the Reports of Indian affairs, both under the War Department and under the present management. Notwithstanding their ignorance they did give us some very precious information. With the growth of anthropological studies, the amount of solid information in the Report of the Commissioner has kept pace. The volume for 1882 contains 525 closely printed pages, and from its correspondence and tables may be gathered a very intelligent understanding of the name, location, number, occupation, education, industry and status of every tribe of Indians with which the Government has to deal. Especial attention is invited to the report of education, now for the first time accorded a separate table (316–327) in which industrial progress is combined with mere school instruction.

Progress of Anthropology in Germany in 1881–1882.—The next best thing to the impracticable task of noting every publication upon a science, is the guidance of the inquirer to the place where he may inform himself. With this motive we take great pleasure in directing attention to the paper of Dr. J. Ranke in *Correspondenz-Blatt*, Vol. xiii, entitled "Wissenschaftlicher Jahresbericht des General sekretärs, Ueber die Fortschritt der Anthropologie in Deutschland in letzten Jahre," pp. 101–124. The subject is treated under the following particulars:

1. General information.
2. Survivals in modern social life.
3. Monographs upon (Alterthunskunde) archæology in general.
4. Local investigations.
5. Questions of race in Germany and contiguous countries.
6. General ethnology.
7. General anthropology.

See also Virchow, report of the commission on the color of the eyes, hair and skin of German school-children, p. 125; Schaaffhausen, report on the anthropological materials in German collections, p. 126; and O. Fraas on the progress of the prehistoric chart of Germany, p. 130; Neuberger on the relation of philology to anthropology; and stenographic report of the thirteenth general meeting of the German Anthropological Society at Frankfort, Aug. 14–17, 1882, pp. 65–227.

A New Anthropological Journal.—The prospectus has been published of a journal entitled, *Internationale Zeitschrift für Allgemeine Sprachwissenschaft* unter Mitwirkung of der Herren L. Adam and twenty others, including A. S. Gatschet, in Washington; F. A. March, in Easton; and W. D. Whitney, in New Haven. F. Techmer, of Leipzig, is editor and Joh. Ambr. Barth,

publisher. The Zeitschrift will appear in semi-annual parts, at twelve marks a year. The scope of the journal furnishes such a good analysis of linguistic study that a translation is given:

I. Natural History of Language (Anthropology of speech).

1. *Acoustic phenomena of expression* (phonetics). Physical phenomena, anatomy, physiology, pathology of the vocal organs and of the ear, difficulties of articulation, deafness, physiological explanation of articulate sounds.
2. *Optical expression* (graphics), physical and anatomical. Physiology of mimicry, gesture speech. Pathology of writing.
3. *Present relation of acoustic and optic expression.*

II. Psychological Side. Relations to psychology. Law of development (inheritance and variation).

1. *Articulation.* Symbols and shifting of articulation.
2. *Sound.* Psychology and shifting of sound.
3. *Roots.* Definition of roots.
4. *Words.* Sematology and change of meaning.
5. *Sentence.* Comparative syntax, including sign language.

III. Historical Side.

1. *Phylogenetic development.* Origin and prehistoric evolution, historic evolution, relation to ethnology, families of speech, &c.
2. *Ontogenetic development.* Child-speech, acquiring foreign languages, &c.

MICROSCOPY.[1]

Method of Putting Pelagic Animals to Sleep in order to obtain their Photographs.—Dr. Fol,[2] of Geneva, has made the important discovery that Cœlenterates and Echinoderms may be rendered insensible and kept so for hours and even days, without injury, by saturating the water with carbonic acid. The containing vessel must, of course, be hermetically closed. The animal at once becomes insensible and motionless, but preserves its natural appearance, and recovers at once when again placed in pure sea-water. This method may be used not only for obtaining life-like photographs, but also, as Dr. Fol suggests, for transporting animals alive. Fishes and mollusks do not survive this treatment, and crustaceans for only a short time.

Dr. Fol tried various narcotics, but found that small doses would not bring the animals to rest, while large doses acted as poisons. The same proved true of tobacco smoke, and aqueous solutions of ether, chloroform and ethyl bromide. Sulphydric acid and carbonic oxide gave satisfactory results in only a few cases.

Hertwig's Method of Preparing and Cutting Amphibian Eggs.[3]—Although the amphibian egg has long been a favorite object of study among embryologists—and quite as much so

[1] Edited by Dr. C. O. Whitman, Newton Highlands, Mass.

[2] *Zoologischer Anzeiger*, No. 128, p. 698, 1882.

[3] Jenaische Zeitschrift für Naturwissenschaft, xvi, p. 249, 1882.

since section-cutting came into vogue as before—comparatively little progress has been made in overcoming the difficulties that attend its preparation for the microtome. The chief difficulties are found in freeing the egg from its gelatinous envelope, and in preparing it so as to avoid brittleness.

The best method that has thus far been proposed for these eggs is unquestionably that of O. Hertwig, and I shall therefore give it in detail.

1. In order to facilitate the removal of the gelatinous envelope, the eggs are placed in water heated almost to boiling (90–96° C.) for 5–10 minutes. The eggs are thus coagulated and somewhat hardened, while the envelope separates a little from the surface of the egg and becomes more brittle. The envelope is then cut under water with sharp scissors, and the egg shaken out through the rupture. With a little experience a single cut suffices to free the egg.

2. By the aid of a glass tube the egg is taken up and transferred to chromic acid (one-half per cent), or to alcohol of seventy, eighty, and ninety per cent. Chromic acid renders the egg brittle, and the more so the longer it acts; therefore the eggs should not be allowed to remain in it more than twelve hours. While eggs hardened in chromic acid never change their form or become soft when transferred to water, those hardened in alcohol, when placed in water or very dilute alcohol, lose their hardness, swell up and often suffer changes in form.

3. Alcoholic preparations are easily stained; but chromic acid preparations are stained with such difficulty and so imperfectly that Hertwig omitted it altogether.

There is an important difference between alcohol and chromic acid in their effect on the pigment of the egg. Chromic acid destroys the pigment to some extent, and thus obliterates, or at least diminishes, the contrast between pigmented and non-pigmented cell-layers. As the distribution of the pigment is of considerable importance in the study of the germ-lamellæ, it is well to supplement preparations in chromic acid with those in alcohol, in which the pigment remains undisturbed.

4. Eggs hardened in chromic acid were imbedded almost exclusively in the egg-mass recommended by Calberla. The great advantage offered by this mass is, that it supplies a sort of antidote to the brittleness of the egg. It glues the cell-layers together, so that the thinnest sections can be obtained without danger of breaking.

5. As the dorsal and ventral surfaces, and the fore and hind ends can be recognized in very early stages, it is important to know precisely how the egg lies in the egg-mass in order to deter-

mine the plane of section. In order to fix the egg in any given position in the imbedding mass, Hertwig proceeds as follows:

a. A small block of the hardened mass is washed in water to remove the alcohol, and in the upper surface of the block, which has been freed from water by the aid of filtering paper, a small hollow is made. This hollow is then wet with the freshly prepared *fluid* mass.

b. The egg is washed in water to remove the alcohol, placed on a piece of filtering paper to get rid of the water, turned on the paper by a fine hair brush until it has the position desired; the point of the brush is next moistened and pressed gently on the upper surface of the egg, the egg adheres to the brush and may thus be transported to the hollow prepared for it in the block.

c. After the egg has thus been placed in position, a drop of absolute alcohol carefully applied will coagulate the "fluid mass" with which the hollow was wet, and thus fix the egg to the block. The block is again washed, and finally imbedded in the egg-mass, which is prepared in the following manner:

Calberla's Method of Imbedding.[1]—The white of several eggs is separated from the yelk, freed from the chalazæ, cut with shears, and thoroughly mixed by shaking with a ten per cent solution of carbonate of sodium (fifteen parts of the white to one part of the solution). The yelk is next added and the mixture shaken vigorously. After removing the foam and floating pieces of yelk by the aid of filtering paper, the so-called "egg-mass" is ready for use. It is this fluid with which the hollow in the solid block is wet, as before mentioned, the block itself being only a piece of the same mixture after it has been hardened in alcohol.

Calberla soaks the eggs a few minutes (5-20) in the fresh white of the egg before imbedding; Hertwig appears to omit this part of the process.

After the egg has been fixed to the block as before indicated (*c*), it is placed in a paper box and covered with the fresh mass (1-2^{cm} deep). The box is then placed in a vessel that contains alcohol (75-80 per cent), enough to bathe its lower half; the vessel, covered with a funnel, is heated over a water bath for 30-40 minutes, care being taken not to *boil* the alcohol. The imbedding substance, thus hardened, is next placed in cold alcohol (ninety per cent), which should be changed once or twice during the first twenty-four hours. After remaining in alcohol for about forty-eight hours the imbedded egg is ready for cutting.

[1] Morphologisches Jahrbuch, II, p. 445, 1876

SCIENTIFIC NEWS.

— A number of American workers in biology desiring to have established an association of American naturalists for business purposes, held a meeting at Springfield, Mass., April 10 and 11, when an organization was effected, and discussions as to laboratory methods and other subjects were held.

The intention is to have an annual meeting for the purpose of discussing topics of common interest for which, at present, no opportunity is afforded, as for example:

Museum interests, in connection with which each museum director could indicate his plan of work, the special groups of which he was making exhaustive collections, so that work may not be uselessly duplicated in many places; methods of museum work, methods of exhibition, etc.

Methods of laboratory work; laboratory technique; new and valuable points in staining, mounting, cutting and preserving of sections.

Systems of instruction in various departments of Natural Science; methods with small elective classes; with large college classes.

The position which the observational sciences should hold in the college curriculum.

The amount of natural science which should appear in college entrance examinations. The amount and character of such instruction in preparatory schools, etc.

At the closing session it was voted to name the organization "The Society of Naturalists of the Eastern United States." Professor A. Hyatt, of the Massachusetts Institute of Technology, was chosen president; Professors H. N. Martin, of Johns Hopkins University, and A. S. Packard, Jr., of Brown University, vice-presidents; and Professor S. F. Clarke, of Williams College, secretary. It has twenty-seven members, representing all prominent colleges in its district.

— The Coast Survey will, during the present season, complete the triangulation connecting the survey of the coast with that of the lakes. Besides the work of surveying and resurveying the coasts, there is now being carried on a system of triangulation which is intended to cover the whole country, and work is now being carried on in ten different States, viz., New Hampshire, Vermont, Pennsylvania, New Jersey, Tennessee, Kentucky, Ohio, Indiana, Illinois and Wisconsin. While this is intended mainly as an aid and to furnish data to the different States which contemplate geological and geodetic work, as in the case of the State of New York, which is doing the work of preliminary triangulation for herself, it is also of great importance to the general government in the establishment of post routes for military purposes,

etc. So many applications have been made to the Coast Survey for data for maps of particular parts of the country, that the Bureau has determined upon the compilation of data for a general map of the United States on a scale of ten miles to the inch, which will be exhaustive and complete so far as that scale will allow. It will be superior to anything in the map line hitherto issued by the government. The map will be published in several parts, and form a sort of atlas, the New England States being in one part, and equal amounts of territory covered by the others. This map will be issued probably during the coming year.

—The 10th annual report for the year 1881 of the Geological and Natural History Survey of Minnesota is a volume of a little over 250 pages, poorly printed on very cheap paper; the maps well engraved, but the other illustrations (not done in the State, however) not of a high order. There is no table of contents. The field work has been continued by Mr. Upham, aided by Mr. H. V. Winchell. Most of the report is devoted to lengthy lists of rocks, and a translation and reprint of Kloos' geological notes on Minnesota, which first appeared in the Journal of the German Geological Society.

The zoölogical portion consists of descriptions, by Mr. C. L. Herrick, of new forms of Copepod and Ostracode Crustacea from the fresh waters of the State, and include a description of a new species of crayfish (*Cambarus signifer*). This part is illustrated by eleven full-page photo-engravings. Considering the many interesting questions connected with the occurrence and distribution of the fresh-water Crustacea, the State authorities might do worse than further the biological studies so well begun in this report.

— Vegetable parasitism in fishes appears, from recent observations by MM. Olivier and Richet, to be so constant that it may be regarded as normal. They examined about 150 different fishes taken in the channel and the Mediterranean, and in all of them they found in the peritoneal liquid, in the lymph, in the blood and so in all the tissues, microbes more or less numerous, having all the characters of land-microbes and capable of similar reproduction. These organisms were mostly the bacterium called Bacillus. (In other vertebrates, it is to be noted, microbes are not found in the blood and the lymph.) The authors cultivated the microbes successfully. They also repeatedly made an experiment which consisted in putting a whole fish or part of it in paraffine melted at 120° or 140°. After solidification the paraffine was coated with several layers of collodion and Canada balsam. The tissues thus guarded from atmospheric germs, all showed, after a few weeks, an extreme development of microbes (which were not those of putrefaction). The authors propose to investigate the mode of

penetration of these parasites and their influence on the vital functions.—*English Mechanic.*

— Professor J. P. Lesley begins, in Proceedings of the American Philosophical Society, No. 112, an interesting biographical notice of the late Swiss naturalist and geologist, Desor, who at one time was so closely identified with American geology and zoölogy during his residence in this country.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Biological Society of Washington, March 30.—Communications were made by Mr. Newton P. Scudder on the length of the hatching period of the domestic fowl; by Dr. Thomas Taylor on section cutting and mounting of hard woods; and on a new parasite in fowls, of the nature of Trichina. Exhibition of specimens included specimens illustrating Accidents to animals, by Mr. F. A. Lucas; The bones of the sea cow (Rhytina), by F. W. True; Another jumping seed, Remarks on bee-fly larvæ and their singular habits, A burrowing butterfly larva, by Professor C. V. Riley. Professor J. W. Chickering, Jr., on Mount Kataadn; Professor L. F. Ward on hybrid oaks of the District of Columbia.

Boston Society of Natural History, March 21.—Professor S. P. Sharples gave an account of a visit to Turk's island; and Mr. S. Garman made some remarks on fossil horses.

April 4.—Professor Hyatt discussed the sudden appearance and quicker evolution of ancient types of animals; and Dr. M. E. Wadsworth spoke of the Bishopville meteorite.

New York Academy of Sciences, April 2.—The following paper was presented: An inquiry into the carbon present in bituminous shales, by Professor John S. Newberry.

Appalachian Mountain Club, March 14.—Mr. R. B. Lawrence read a paper entitled, "Two weeks in Norway," illustrated by the lantern; Professor E. C. Pickering read a paper on mountain observatories; and Mr. A. E. Scott spoke on the exploration of the Twin Mountain range.

Proceedings of the Philadelphia Academy of Sciences, Feb. 13.—Papers presented: "On a new Unio from Florida," by B. H. Wright; "Catalogue of the Fishes of the Atlantic Coast," by Jos. Swain and G. B. Kolb; "Notes on the Birds of Westmoreland county," by C. H. Townsend. Mr. Townsend called attention to the albino birds in the collection of the Academy. Dr.

Leidy stated that the Anodontas brought to him were infested with water-mites, marked with a Y-shaped yellow band; he identified the species with the *Atax ypsilophorus*, described by Bonz a hundred years ago, as found in *Anodonta cygnea* of Europe. Professor Heilprin attacked the theory of a great ice-mountain in the north during the glacial era. In temperate regions clouds descend in winter to 5000 or even 3060 feet, and it is impossible for snow to form above the vapor line; how high this may be in the Arctic regions is not known, but it can scarcely be higher than 6000 feet, which would render the filing up of ice to such a height that it would flow southward over the area believed to have been glaciated a physical impossibility. Professor Lewis brought forward the evidence of the striæ and boulders in favor of a continuous ice flow, and stated that the ice in Greenland is now 6000 feet thick. Professor Heilprin believed 2000 feet to be more nearly correct, and said that the thickness of bergs was greatly over-estimated, as the part under water was usually assumed to be equal in horizontal extent with that above, whereas, in fact, it was, in most cases, much greater.

Feb. 20.—Professor Lewis read a paper by Miss Foulke describing the formation and liberation from the interior of *Volvox globator*, of amœboids, which showed their animal nature by devouring the gonidea of the Volvox. These amœboids were in several cases seen to assume a form closely resembling that of *Actinophrys sol.* Mr. Cresson presented a hammer of native copper, with a laminar surface and structure caused by hammering pieces of native copper together while cold; he called attention to a half hole in this hammer, a feature found in the hammers of the Eastern continent in Neolithic and later periods. Dr. J. Skinner communicated an instance of insect intelligence. A small beetle which had been knocked off a leaf on to a pavement came to a fallen leaf, and immediately threw itself on its back and pulled the leaf over its body to hide itself.